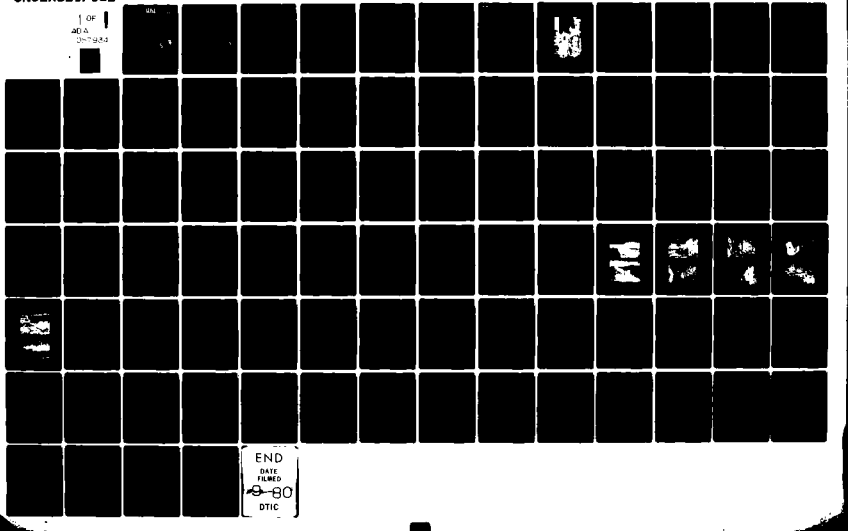
AD-A087 934 GANNETT FLEMING CORDDRY AND CARPENTER INC HARRISBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. BROWN'S LAKE DAM (NDI ID NUMBE--ETC(U)
JUN 80 F FUTCHKO DACW31-80-C-0017

UNCLASSIFIED NL



END
DATE FILMED
8-80
DTIC

DELAWARE RIVER BASIN
STONY RUN, MONROE COUNTY

PENNSYLVANIA

BROWN'S LAKE DAM

NDI ID NO. PA-00630
DER ID NO. 45-108

AMELIO SCOTT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JUNE 1980

GANNETT FLEMING CORDDRY AND CARPENTER
DACW31-80-C-0017

DELAWARE RIVER BASIN

STONY RUN, MONROE COUNTY

PENNSYLVANIA

(12) 12L (11) Jun 80

BROWN'S LAKE DAM

NDI ID No. PA-00630
DER ID No. 45-108

AMELIO SCOTT

(13) DA-W31-09-C-0017

PHASE I INSPECTION REPORT

(6) NATIONAL DAM INSPECTION PROGRAM. Brown's Lake Dam (NDI ID Number PA-00630, DER ID Number 45-108). Delaware River Basin, Stony Run, Monroe County, Pennsylvania. Phase I Inspection Report.

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
P.O. Box 1963
Harrisburg, Pennsylvania 17105

For

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JUNE 1980

42 001 11

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN

STONY RUN, MONROE COUNTY

PENNSYLVANIA

BROWN'S LAKE DAM

NDI ID No. PA-00630
DER ID No. 45-108

AMELIO SCOTT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JUNE 1980

CONTENTS

APPENDICES

PHASE I INSPECTION REPORT

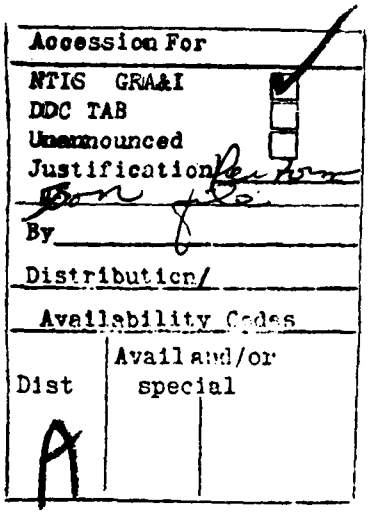
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Brown's Lake Dam NDI ID No. PA-00630 DER ID No. 45-108
Size:	Intermediate (18 feet high; 1,121 acre-feet)
Hazard Classification:	High
Owner:	Amelio Scott 205 Davey Avenue Pen Argyl, PA 18072
State Located:	Pennsylvania
County Located:	Monroe
Stream:	Stony Run
Date of Inspection:	1 May 1980



Based on available records, visual inspection, calculations, and past operational performance, Brown's Lake Dam is judged to be in poor condition. Based on the size and hazard classification of the dam, the recommended Spillway Design Flood is the Probable Maximum Flood (PMF). The spillway can pass about 82 percent of the PMF. Since the dam cannot pass the PMF but can pass the 1/2 PMF, the spillway capacity is rated as inadequate.

Deficiencies exist that are considered to be pertinent to the stability of the dam. The deficiencies include the following: seepage, steep slopes, a depression on the top of the dam, growth of trees on the dam, and holes and a depression on the downstream slope of the dam. The type of design and methods of construction increase the concern for the deficiencies.

The condition of the outlet works is unsatisfactory. There are no upstream closure facilities. Maintenance of the dam is inadequate.

The following investigations and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform detailed investigations as required to assess the stability of the dam. The investigations should include assessment of seepage conditions and piping potential. Take appropriate action as required.

(2) Until the investigations recommended above are complete, the Owner should institute a monitoring program to detect any significant change in the condition of the dam. If conditions change, take appropriate action as required.

(3) Take action as necessary to restore the outlet works to a working condition and provide upstream closure facilities.

(4) Remove brush and trees on and near the dam and appurtenant structures.

(5) Undertake remedial measures as necessary to prevent additional erosion of the embankment and the spillway outlet channel.

(6) Remove debris from the spillway and visually monitor the condition of the spillway structures. Maintain the structures as required.

All investigations, monitoring programs, and design of remedial measures should be performed by a professional engineer experienced in the design and construction of dams. Tree removal should be performed under the guidance of a professional engineer.

In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Brown's Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Brown's Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is visited frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a maintenance program so that all features of the dam are properly maintained.

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 27 June 1980

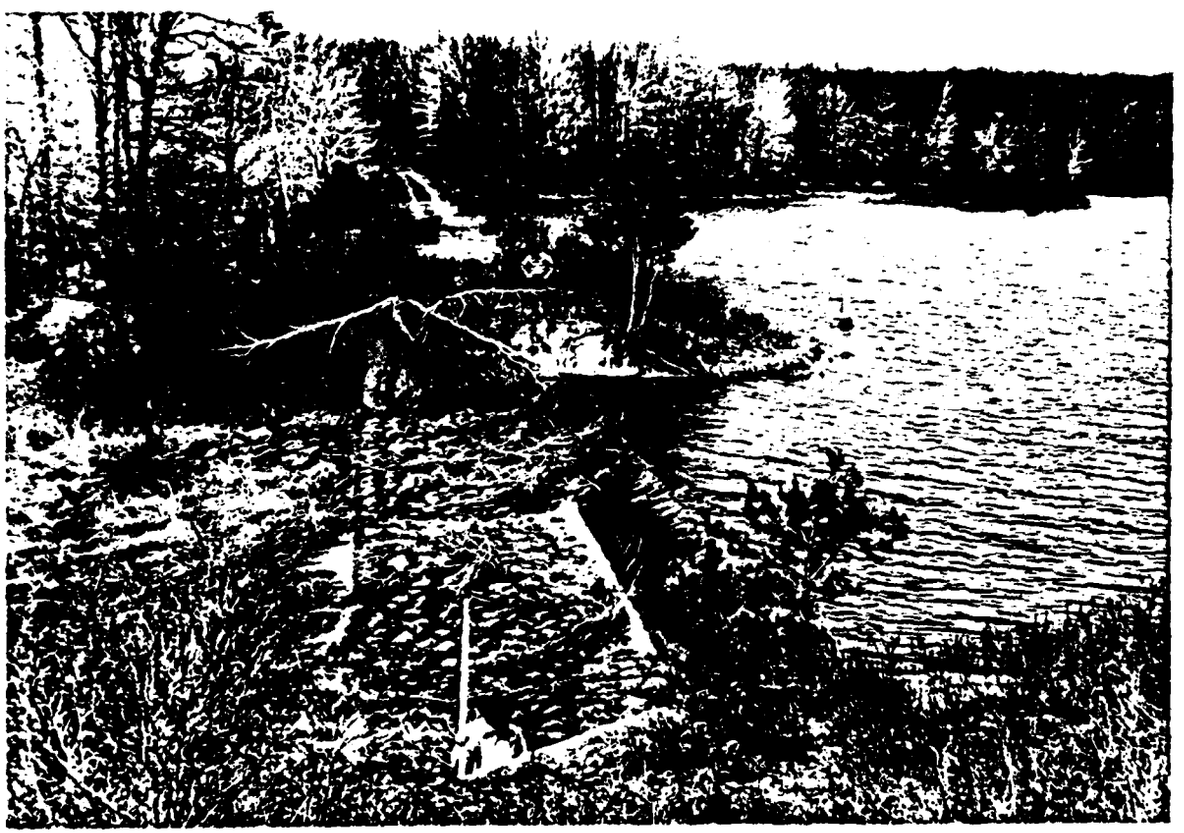
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 14 JULY 1980

BROWN'S LAKE DAM



DELAWARE RIVER BASIN

STONY RUN, MONROE COUNTY

PENNSYLVANIA

BROWN'S LAKE DAM

NDI ID No. PA-00630
DER ID No. 45-108

AMELIO SCOTT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JUNE 1980

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. The embankment of Brown's Lake Dam has a timber corewall with an earthfill zone upstream and rockfill and earthfill zones downstream. The embankment is 560 feet long and 18 feet high at its maximum section.

The spillway is located at the left abutment. It consists of a triangular, concrete weir with a crest length of 99 feet. A concrete apron is located along the downstream side of the weir. The spillway outlet channel is an excavated, earthen channel.

The outlet works is located near the maximum section of the dam. It consists of a 16-inch diameter, cast-iron pipe with a gate valve near its downstream end. There is no known intake structure.

The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is included in Appendix F.

b. Location. Brown's Lake Dam is located on Stony Run in Barrett Township, Monroe County, Pennsylvania, approximately 3 miles northeast of Canadensis, Pennsylvania. Brown's Lake Dam is shown on the 1973 photorevision to USGS Quadrangle, Skytop, Pennsylvania, at latitude N 41° 12' 30" and longitude W 75° 11' 20". A location map is shown on Plate E-1.

c. Size Classification. Intermediate (18 feet high, 1,121 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Brown's Lake Dam (Paragraphs 3.1e and 5.1c (5)).

e. Ownership. Amelio Scott, 205 Davey Avenue, Pen Argyl, Pennsylvania 18072.

f. Purpose of Dam. Recreation.

g. Design and Construction History. Brown's Lake Dam was designed for F. W. Brown by John L. Westbrook, Civil Engineer, in 1922. Construction commenced in 1923. The original design is shown on Plate E-2. An inspection report prepared by the Commonwealth in 1923 noted that departures from the design were being made during construction, the most notable being substitution of hand-placed rockfill for earthfill downstream from the timber corewall. Another inspection report in 1925 indicates that the dam was not complete, but it was impounding water. In 1929, earthfill was dumped over the hand-placed rockfill along the downstream side of the dam. In 1930, additional earthfill was reportedly added to the top of the dam and on the upstream and downstream slopes.

Between 1930 and 1932, some stone was placed on the upstream slope for protection against wave erosion. Between 1933 and 1944, the Commonwealth made several inspections. Their inspection reports indicate that by 1944 the dam still had not been completed in accordance with the design. In particular, the downstream slope was steeper than the approved 1V on 2H design slope.

The August 1955 flood washed out the spillway. In September 1955, E. C. Hess, Civil Engineer, prepared plans for a new spillway. As part of this design, about 100 feet of additional embankment was constructed at the left end of the dam. The design also included adding 0.5 foot of fill along the entire top of the dam. The work was completed by November 1955.

In 1957, Mr. C. W. Brown, who was then the Owner, requested assistance in evaluating seepage from the dam. Records indicate that the tests performed by Mr. Brown were not successful in determining the source or cause of the seepage. Records also indicate that Mr. Brown dumped about 500 cubic yards of soil on the upstream slope in the vicinity of the seepage. It was reported that the seepage was turbid for a short period of time, and then the seepage stopped. There have been no other known modifications since 1957.

h. Normal Operational Procedure. The pool is maintained at the spillway crest level with excess inflow discharging over the spillway. The outlet works is not used. Spillway discharge flows downstream in Stony Run to the confluence with Brodhead Creek.

1.3 Pertinent Data. (existing conditions except as noted.)

a.	Drainage Area. (square miles)	2.4
b.	Discharge at Damsite. (cfs.)	
	Maximum known flood at damsite	1955 Flood. Discharge Unknown.
	Outlet works at maximum pool elevation	Unknown.
	Spillway capacity at maximum pool elevation	3,200

c. Elevation. (feet above msl.)

Top of dam	1278.5
Maximum pool	1278.5
Normal pool (spillway crest)	1274.1
Upstream invert outlet works	Unknown.
Downstream invert outlet works	Unknown.
Streambed at toe of dam	1260.9

d. Reservoir Length. (miles)

Normal pool	0.85
Maximum pool	1.04

e. Storage. (acre-feet)

Normal pool	498
Maximum pool	1,121

f. Reservoir Surface. (acres)

Normal pool	115
Maximum pool	163

g. Dam.

Type	Earthfill and rockfill with a timber corewall.
Length (feet)	560
Height (feet)	18
Topwidth (feet)	10.5
Side Slopes	Vary - see Appendix B.
Zoning	Earthfill upstream; rockfill and earthfill downstream.
Cut-off	Earthfill in trench.
Grout Curtain	None.
Corewall	Wood sheeting.

h.	Diversion and Regulating Tunnel.	None.
i.	Spillway.	
	Type	Triangular concrete weir.
	Length of Weir (feet)	99.0
	Crest Elevation	1274.1
	Upstream Channel	Reservoir.
	Downstream Channel	Concrete apron and earthen channel.
j.	Regulating Outlets.	
	Type	One 16-inch dia. CIP
	Length (feet)	100 (approx.)
	Closure	Gate valve at downstream toe of dam.
	Access	Toe of dam.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Design data available for review included the following: design drawings and specifications for the original structures, design drawings for the 1955 modifications, and permit application reports.

b. Design Features. The project is described in Paragraph 1.2a. The various design features of the dam are shown on the Photographs in Appendix C and on Plates E-2 and E-3 in Appendix E. The embankment is shown on Photographs A through H. The spillway is shown on Photographs I and J.

c. Design Considerations. One feature of the original design that is significant is the wood-sheeting corewall. The original design drawings and specifications indicate that it consists of two layers of hemlock planks having a total thickness of 3 inches. The drawings show staggered vertical joints. No preservative treatments were specified. The wood has now been in place for 57 years. Although decay of wood is greatly inhibited when the wood is kept continuously wet, the condition of the corewall is suspect. Untreated hemlock wood has low to moderate decay resistance, depending on the quality of hemlock that is used. Based on the age, type of material, and service conditions, the corewall might be approaching the end of its useful life. Deterioration of the corewall could have significant affect on the dam. Seepage could increase substantially, which could cause stability or piping (internal erosion) problems.

2.2 Construction.

a. Data Available. Construction data available for review consists of several photographs and various progress reports and memoranda prepared by the Commonwealth concerning the construction.

b. Construction Considerations. Available construction data document departures from the original design. A construction progress report was prepared in July 1923 by the Commonwealth. At that time, the timber

corewall was in place, and several feet of earthfill had been placed upstream from the corewall. The earthfill material was reported to be "of good quality and solidly compacted. On the downstream side of the corewall, hand-placed rockfill had been substituted for the proposed earthfill." Since the approved design required clay to be placed in the cutoff trench, the Commonwealth directed the Owner to remove some of the rockfill and replace it with clay. There is no verification that the work was performed.

The next construction progress report was prepared in July 1924. At that time the embankment was nearly to its full height, but the slopes were not constructed as designed. The only deficiency noted in the report was leakage near the outlet conduit. Although not noted in the report, photographs taken during the inspection indicate that deficiencies might also have existed in preparation of the foundation for the dam. The 1924 photographs show a large tree near the downstream toe surrounded by rockfill. Apparently, removal of the tree was deemed unnecessary. There are no reports available concerning the adequacy of the foundation preparation.

Additional fill was placed on the downstream slope of the dam in 1929. A Commonwealth report prepared at that time indicates that earthfill was dumped over the rockfill with no compaction. Placement of earthfill continued through 1930, but records indicate that the downstream slope was never completely finished in accordance with the approved plans.

The available data is adequate to make several assessments concerning construction of the dam. First, the substitution of rockfill for earthfill along the downstream side of the corewall was an important change. The upstream earthfill is separated from the relatively coarse, downstream rockfill only by the timber corewall. Prevention of piping would appear to rely mainly on the integrity of the corewall. Second, the placement of loose earthfill over the rockfill probably added little to the stability of the dam. Uncompacted earthfill has relatively low density and strength. Lastly, there are some indications that the foundation preparation was not satisfactory, which could adversely affect both stability and seepage.

2.3 Operation. There are no formal records of operation. A record of operation does exist in the form of inspection reports prepared by the Commonwealth between 1924 and

1966. The findings of these previous inspections are discussed in other applicable sections of this Report.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER).

b. Adequacy. The type and amount of available design data and other engineering data are limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is poor. Deficiencies were observed as noted below. A sketch of the dam with the locations of deficiencies is presented in Exhibit B-1 in Appendix B. Survey information acquired for this Report is summarized in Appendix B. On the day of the inspection, the pool was at its normal level. The survey datum was an approximate elevation obtained for the spillway crest from a USGS map. The Owner uses a different datum. To convert the elevations on Plate E-3, one should add 1,165 feet to the elevations; about 1,174.5 feet should be added to the elevations on Plate E-2.

b. Embankment. The upstream slope of the dam is covered with light brush and small trees (Photograph A). As shown on the surveyed sections in Appendix B, the slope is irregular. Riprap is generally intact on the 100-foot long reach of embankment that was constructed in 1955, which is adjacent to the right end of the spillway. Over the remaining portion, which is the original embankment constructed in 1923, only a minor amount of riprap is apparent above normal pool level. Below normal pool level, stone having a 12-inch maximum size is visible. Minor erosion due to wave action has occurred on the upstream slope.

The top of the dam has an average width of 10.5 feet. A profile of the dam is included in Appendix B. The lowest point on the top is at Elevation 1274.5. A depression about 3 feet in diameter and 2 feet deep is on the top of the dam approximately 185 feet to the right of the spillway. The depression is near the upstream edge of the top (Photograph B).

The downstream slope of the dam has heavy brush and about 15 trees at scattered locations growing on it (Photograph C). In addition to the live trees, there was one tree stump. As shown on the surveyed sections in Appendix B, the downstream slope is irregular. Four holes and one depression are on the downstream slope. Their locations are shown on Exhibit B-1 in Appendix B. The holes range in size from 0.25 foot in diameter by 1.5 feet

deep to 1 foot in diameter by 3.5 feet deep. All the holes are vertical. One hole appeared to contain remains of a rotted stump. There were no indications that the holes were created by animals. The three largest holes are shown on Photographs D, E, and F. The depression on the downstream slope is located near the toe about 165 feet right of the spillway. Two rotted posts, about 2 feet apart, were located on the uphill side of the depression (Photograph G).

Clear seepage was observed at several locations along the toe of the dam. The largest single source that was visible was about 2 gallons per minute (gpm), and the flow was exiting from the stone masonry structure at the outlet works. The locations and magnitudes of the seepage are shown on Exhibit B-1 in Appendix B. In addition to the seepage that was visible, other seepage might have been obscured by a pool of standing water and a large swampy area located along the toe. The pool of standing water was about 45 feet wide by 80 feet long (Photograph H) and was located at the maximum section of the dam. The swampy area was triangular in shape, beginning at the right abutment and reaching a maximum width of 125 feet near the maximum section of the dam. It was estimated that the combined outflow from all sources (seepage points, pool of standing water, and the swampy area) was about 20 gpm.

c. Appurtenant Structures. The spillway is in fair condition (Photograph I). The left abutment wall has a slight, inward tilt, two cracks, and minor spalling at its base adjacent to the spillway weir. The spillway weir is a low, triangular, concrete weir. A concrete apron extends downstream from the weir for a distance of about 10 feet. Some debris was on the spillway on the day of the inspection. The weir has two areas where the concrete has cracked and spalled. Both areas are near the right end of the weir. The right abutment wall has trees and brush growing behind it. The spillway outlet channel is an excavated earthen channel (Photograph J). It appears that the channel has been subject to retrogressive erosion.

The condition of the outlet works could not be determined during the visual inspection. Only a small portion of the conduit and part of the gate valve were visible at the downstream toe of the dam. The gate valve was rusted, and the end of the conduit could not be located. It is apparently covered with mud.

d. Reservoir Area. The watershed is about 90 percent wooded and about 10 percent grassland. There is only minor development within the watershed. Slopes are generally mild, and swampy areas are common.

e. Downstream Channel. Stony Run extends downstream from the dam in a wooded valley. Several beaver dams are located in the first two-mile reach downstream. About 2.7 miles downstream, Stony Run passes under a roadway that is part of a relatively new housing development. None of the houses in the development are low-lying. About 3.8 miles downstream, Snow Hill Road crosses Stony Run. In the next 0.8-mile reach, there are approximately 6 low-lying dwellings along Stony Run. About 6.0 miles downstream from the dam, Stony Run passes under Pa. Route 447 and enters Brodhead Creek.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at normal pool level with excess inflow discharging over the spillway and into the downstream channel. The outlet works is not used.

4.2 Maintenance of Dam. A former Owner of the dam, C. W. Brown, lives at the site and leases the lake from the current Owner. Although there are no formal arrangements, Mr. Brown, who has lived at the site since 1948, apparently acts as caretaker for the dam. Mr. Brown stated that he occasionally cuts the brush and removes debris from the spillway.

4.3 Maintenance of Operating Facilities. The outlet works is not maintained. Mr. Brown stated that the valve has not been operated since 1955, when repairs to the spillway were made.

4.4 Warning Systems in Effect. There is no emergency operation and warning system in effect. The caretaker stated that he checks the condition of the dam during periods of heavy rainfall.

4.5 Evaluation of Operational Adequacy. The maintenance of the dam is inadequate. Frequent inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop, and to prevent loss of life should the dam fail.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. Review of the design drawings for the spillway (Plate E-3) and the permit application report indicate that changes were made during construction. As designed, the spillway was a 100-foot long, concrete ogee weir with a head of 4.5 feet. As designed, the spillway outlet channel was curved with stone protection for a distance of approximately 140 feet downstream from the spillway. In their analysis of the proposed 1955 repairs to the dam, the Commonwealth estimated the design discharge capacity of the spillway to be 3,630 cfs. As built, the spillway has a 99-foot long, triangular, concrete weir with a maximum head of 4.4 feet. The existing spillway capacity estimated and used for this Report is 3,198 cfs. The as-built outlet channel is straight. Stone protection is intact only for a short distance downstream from the spillway.

b. Experience Data. The flood of record is Tropical Storm Diane of August 1955, when the original spillway washed out. There are no data to estimate the flow for this storm.

c. Visual Observations.

(1) General. The visual inspection of Brown's Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low point on the top of the dam is at Elevation 1278.5, which results in a maximum available head at the spillway of 4.4 feet.

(3) Appurtenant Structures. The spalled areas and debris on the spillway weir are maintenance items and do not significantly affect the hydraulic performance of the spillway.

The ability of the outlet works to function is uncertain. Conditions at the upstream end are unknown,

the valve has not been operated in 25 years, and the downstream end of the conduit is apparently buried. There are no upstream closure facilities.

(4) Reservoir Area. No conditions were observed in the reservoir area that might present a hazard to the dam. The drainage area of 2.40 square miles that is used in this Report is based on recent USGS mapping. The drainage area of 2.30 square miles in the records was apparently based on 1955 mapping. The reservoir storage figures used in this Report were based on data obtained from USGS mapping and from data in the PennDER files.

(5) Downstream Conditions. A failure of the dam would cause flooding at a minimum of 6 dwellings with the potential for loss of life. Downstream conditions indicate that a high hazard classification is warranted for Brown's Lake Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Intermediate) and hazard potential (High) of Brown's Lake Dam is the Probable Maximum Flood (PMF). The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The hydrologic and hydraulic assessment of the dam is based on existing conditions and the effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Brown's Lake Dam can pass about 82 percent of the PMF without overtopping of the dam. The dam is rated at its existing top elevation.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Because the dam can pass the 1/2 PMF but not the PMF, the spillway capacity is rated as inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Brown's Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. Erosion due to wave action on the upstream slope has probably contributed to the steep slopes that exist at and above normal pool level. Stone protection that was once in place has apparently been displaced. The erosion has not been sufficient to create a serious hazard at present, but continued erosion will probably occur.

The irregularity of the upstream slope is the result of adding earthfill at various times and at various locations. Survey data acquired for this inspection indicate that the steepness of the slope varies greatly from one section to another. Slope angles could not be determined for the submerged portion of the embankment during this inspection. There were no indications of slope failure at the time of the inspection.

The depression on the top of the dam indicates that potentially hazardous conditions might exist within the embankment. The caretaker stated that the depression developed about 5 years ago, and that it has not increased in size since then. The most likely explanation for the depression is that piping of the upstream earthfill into the downstream rockfill was initiated by seepage through or over the timber corewall. It is not known whether the pool level was above normal when the depression developed. The piping, if it occurred, probably stopped either by a self-healing process or by a return to normal pool level.

The brush and trees at various locations on the dam create a hazard. Root systems can loosen embankment material, displace slope protection, and create paths

along which seepage and piping might occur. The large size of some of the trees and the existence of at least one stump increases the hazard potential.

The 4 holes and the depression on the downstream slope are of concern. The caretaker stated that he was unaware of the holes. One of the holes might have resulted from deterioration of a tree stump, as indicated by rotted wood fragments in the hole. The origin of the other holes is less certain. There were no signs that the holes were created by animals. One possible cause of the holes and the depression might be migration of overlying earthfill into the underlying rockfill. The records indicate that no filter material was placed between the fine and coarse materials.

Seepage, wet areas, and swampy areas along the toe have been documented since the dam was completed. Descriptions contained in previous inspection reports are, in general, of insufficient detail for good comparison with present conditions. Variability between reports suggests that seepage conditions have not necessarily remained the same over the years. As discussed in Paragraph 1.2g, in 1957, an attempt was made to determine the cause and source of seepage and to eliminate the seepage. All seepage observed during this inspection was clear. Several local areas with concentrated seepage were identified, but the wet area and the swampy area along the toe could easily have obscured other seepage areas. Because of the design of the dam and because of conditions at the time of inspection, seepage from Brown's Lake Dam is considered to be potentially hazardous due to a potential for piping.

(3) Appurtenant Structures. The cracking, spalling, and slight inward tilt of the left spillway wall do not appear to be significant hazards at the present time. Even if the left wall were to fail, failure of the dam would not necessarily occur. The condition of the spillway outlet channel is such that retrogressive erosion might eventually endanger the spillway structures.

There are no upstream closure facilities for the outlet works. Lack of upstream closure facilities is a hazard to the dam. If leakage from the conduit were to develop, there would be no way to stop it. The fact that a clear flow of water from the masonry structure at the outlet works was present during the inspection increases concern for lack of upstream closure facilities.

b. Design and Construction Data. Review of available design and construction data raises some concern for stability of the dam. Design and construction considerations are covered in Paragraphs 2.1c. and 2.2b., respectively. There is uncertainty as to the steepness of the upstream slope. Records indicate that some earthfill on both the upstream and downstream slopes was not compacted. There also is evidence that foundation preparation was not adequate in all areas.

There is no stability analysis available for the spillway. However, the structure is small and appears to have been keyed deeply into the foundation. Based on the design drawings, the stability of the spillway weir appears to be adequate.

c. Operating Records. There are no formal records of operation. The available data indicate that seepage has been a problem throughout the life of the dam. A relatively recent occurrence of significance is the development of a depression on top of the dam. There are no records indicating that any slope movements have occurred over the life of the dam.

d. Post-construction Changes. The post-construction changes were assessed previously in this Report.

e. Seismic Stability. Because there are some concerns for the stability of Brown's Lake Dam under normal operating conditions, it cannot be assumed that Brown's Lake Dam would be stable under earthquake conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Brown's Lake Dam is judged to be in poor condition. Based on the size and hazard classification of the dam, the recommended Spillway Design Flood is the PMF. The spillway can pass about 82 percent of the PMF. Since the dam cannot pass the PMF but can pass the 1/2 PMF, the spillway capacity is rated as inadequate.

(2) Deficiencies exist that are considered to be pertinent to the stability of the dam. The deficiencies include the following: seepage, steep slopes, a depression on top of the dam, growth of trees on the dam, and holes and a depression on the downstream slope of the dam. The type of design and methods of construction increase the concern for the deficiencies.

(3) The condition of the outlet works is unsatisfactory. There are no upstream closure facilities.

(4) Maintenance of the dam is inadequate.

(5) A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiency
Embankment:	Brush and trees; minor erosion due to wave action; depression on top of dam; 4 holes and a depression on the downstream slope; seepage, wet areas, and a swampy area at the downstream toe.

Feature and Location	Observed Deficiency
Spillway:	Left wall cracked and tilted slightly; weir deteriorated at two locations; debris on weir; erosion of outlet channel.
Outlet Works:	Not maintained; no upstream closure facilities; leakage through masonry structure near outlet conduit.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following investigations and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform detailed investigations as required to assess the stability of the dam. The investigations should include assessment of seepage conditions and piping potential. Take appropriate action as required.

(2) Until the investigations recommended above are complete, the Owner should institute a monitoring program to detect any significant change in the condition of the dam. If conditions change, take appropriate action as required.

(3) Take action as necessary to restore the outlet works to a working condition and provide upstream closure facilities.

(4) Remove brush and trees on and near the dam and appurtenant structures.

(5) Undertake remedial measures as necessary to prevent additional erosion of the embankment and the spillway outlet channel.

(6) Remove debris from the spillway and visually monitor the condition of the spillway structures. Maintain the structures as required.

All investigations, monitoring programs, and design of remedial measures should be performed by a professional engineer experienced in the design and construction of dams. Tree removal should be performed under the guidance of a professional engineer.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Brown's Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Brown's Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is visited frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a maintenance program so that all features of the dam are properly maintained.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Brown's Lake Dam

NDI ID NO.: PA-00630 DER ID NO.: 45-108

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	Design drawings only. See Plates E-2 and E-3 in Appendix E.
REGIONAL VICINITY MAP	See Plate E-1.
CONSTRUCTION HISTORY	Designed 1922; construction started 1923; work suspended 1924 before entirely complete; additional fill placed 1929; new spillway 1955; additional fill 1957.
TYPICAL SECTIONS OF DAM	As-builts not available; See Plates E-2 and E-3 for typical design sections.
OUTLETS: Plan Details Constraints Discharge Ratings	See Plate E-2. No details or discharge ratings.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None.
DESIGN REPORTS	Permit application reports for original construction (1922) and new spillway (1955)
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	None. Estimated spillway capacity of new spillway in 1955 permit application report.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	None.
POSTCONSTRUCTION SURVEYS OF DAM	None.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	Onsite. Exact location unknown.
MONITORING SYSTEMS	None.
MODIFICATIONS	New spillway constructed 1955. Additional fill added 1957.
HIGH POOL RECORDS	None.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	Spillway failure during August 1955 Flood. No description available.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None.
SPILLWAY: Plan Sections Details	See Plate E-3.
OPERATING EQUIPMENT: Plans Details	None.
PREVIOUS INSPECTIONS Dates Deficiencies	1926: Crest uneven; downstream face uneven; leakage at toe left of center, in valley 25' downstream, and around rt. end; wet and swampy at toe. 1928: Crest uneven and low; downstream slope not in accordance with plans; leakage along entire length; swampy and standing water at toe; spillway not in accordance with plans. 1929: Crest uneven; downstream slope uneven with slight erosion; considerable leakage at old streambed; swampy at right toe. 1934: Crest low and narrow; swampy at toe; no leakage; dam still unfinished.

ITEM	REMARKS
PREVIOUS INSPECTIONS (Cont'd)	1935: Crest uneven; downstream slope uneven; rt. abutment of spillway tilted; two large leaks and general seepage over 25' length located 100' rt. of spillway; large leak 200' from rt. end of dam; leakage at rt. end; swampy at toe; logs in spillway. 1937: Crest uneven; brush and weeds on downstream slope; seepage along toe; swampy at toe. 1944: Crest uneven; downstream slope steep (1V on 1.25 H) and covered with heavy brush; leakage under rt. end spillway and throughout entire embankment at toe; swampy at toe. 1957: Small leak at toe 100' south of spillway. 1966: No deficiencies noted.

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Brown's Lake Dam County: Monroe. State: Pennsylvania.

NDI ID No.: PA-00630 DER ID No.: 45-108

Type of Dam: Earthfill with Timber Core Hazard Category: High

Date(s) Inspection: 1 May 1980 Weather: Clear Temperature: 65° F

Light rainfall occurred for several days prior to inspection.

Pool Elevation at Time of Inspection: 1279.2 msl/Tailwater at Time of Inspection: 1261.2 msl

Datum based on approx. elevation for spillway obtained from USGS map.

Inspection Personnel:

A. H. Whitman (GFCC) J. Chernesky (Penn DER)

D. R. Ebersole (GFCC)

D. B. Wilson (GFCC) Recorder

B-1

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None apparent.	Depression on top of dam and depression and holes on downstream slope. See descriptions Sht. B-4.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None apparent.	
SLOUGHING OR EROSION: **Embankment Slopes** **Abutment Slopes**	Upstream slope steep but no apparent sloughing. Downstream slope steep and very irregular.	See typical sections at end of Appendix B.
CREST ALIGNMENT: **Vertical** **Horizontal**	See survey data at end of Appendix B.	
RIPRAP FAILURES	Riprap not uniform and not to top of dam; poor vegetal cover; minor wave erosion on upstream slope.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	Right abutment - no deficiencies. Spillway - trees and brush.	
ANY NOTICEABLE SEEPAGE	Large swampy areas and wet areas; some visible sources of seepage. All flow is clear.	See Exhibit B-1 for locations of wet areas and seepage.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	
TREES AND BRUSH	Misc. trees and light brush on upstream slope; light brush on crest; light brush and approx. 15 trees on downstream slope.	Trees and brush are at scattered locations. Largest tree approx. 8" dia. One 6" dia. stump.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
TOP OF DAM AND DOWNSTREAM SLOPE	1. Depression on top of dam 185' right of spillway near upstream edge: 3' dia. x 2' deep. 2. Hole on downstream slope 100' right of spillway 4' above toe: 1' dia. x 3' deep. 3. Hole on downstream slope 125' right of spillway 4' below top of dam: 1' dia. x 3.5' deep. 4. Hole on downstream slope 130' right of spillway 2' above toe: 6" dia. x 2' deep 5. Depression on downstream slope 165' right of spillway: 2' dia. x 2' deep. Approx. 5' above toe. 6. Hole 3" dia. x 1.5' deep 10' right of outlet works	1. Brush growing in depression; probed additional 6" and hit rocks. 2. Evidence of a tree stump in hole. No sound of running water. 3. Origin unknown. Could not hear running water. Hole is vertical. 4. Origin uncertain. No sound of running water. 5. Rotted stumps or posts 2' apart at uphill side of depression. 6. Located 3' above toe.

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet conduit not visible - apparently covered with mud.	
INTAKE STRUCTURE	No visible intake structure.	
OUTLET STRUCTURE	Dry masonry enclosure at toe of dam.	Heavy seepage through wall of structure. Approx. 2 gpm clear flow just above gate valve.
OUTLET CHANNEL	Leads to pool of standing water at toe dam.	Light brush in channel.
EMERGENCY GATE	Partially exposed gate valve at toe of dam. Valve rusted. Not operated during inspection.	Downstream end of outlet conduit not located - apparently buried.

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	1. Spalled area 3'x3' located 25' from right end. 2. Cracked and spalled area 6' from right end.	Spalled areas are maintenance items. Also, some debris on weir.
APPROACH CHANNEL	Reservoir area - no apparent deficiencies.	
DISCHARGE CHANNEL	Excavated channel. No erosion protection downstream from conc. apron	Some potential exists for eventual damage to spillway due to retrogressive erosion of discharge channel.
BRIDGE AND PIERS	None.	
ABUTMENT WALLS	1. Left wall has slight inward tilt, spalling @ base, and 2 cracks. 2. Rt. wall - trees and brush	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: **Obstructions** **Debris** **Other**	Wooded valley; no obstructions that would affect dam.	
SLOPES	Vary from mild to steep.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Approx. 6 low-lying dwellings along Stony Cr. from 3.8 to 4.6 miles downstream.	One roadway @ 2.7 miles downstream; Second roadway @ 3.8 miles downstream; Third roadway @ 6.0 miles.

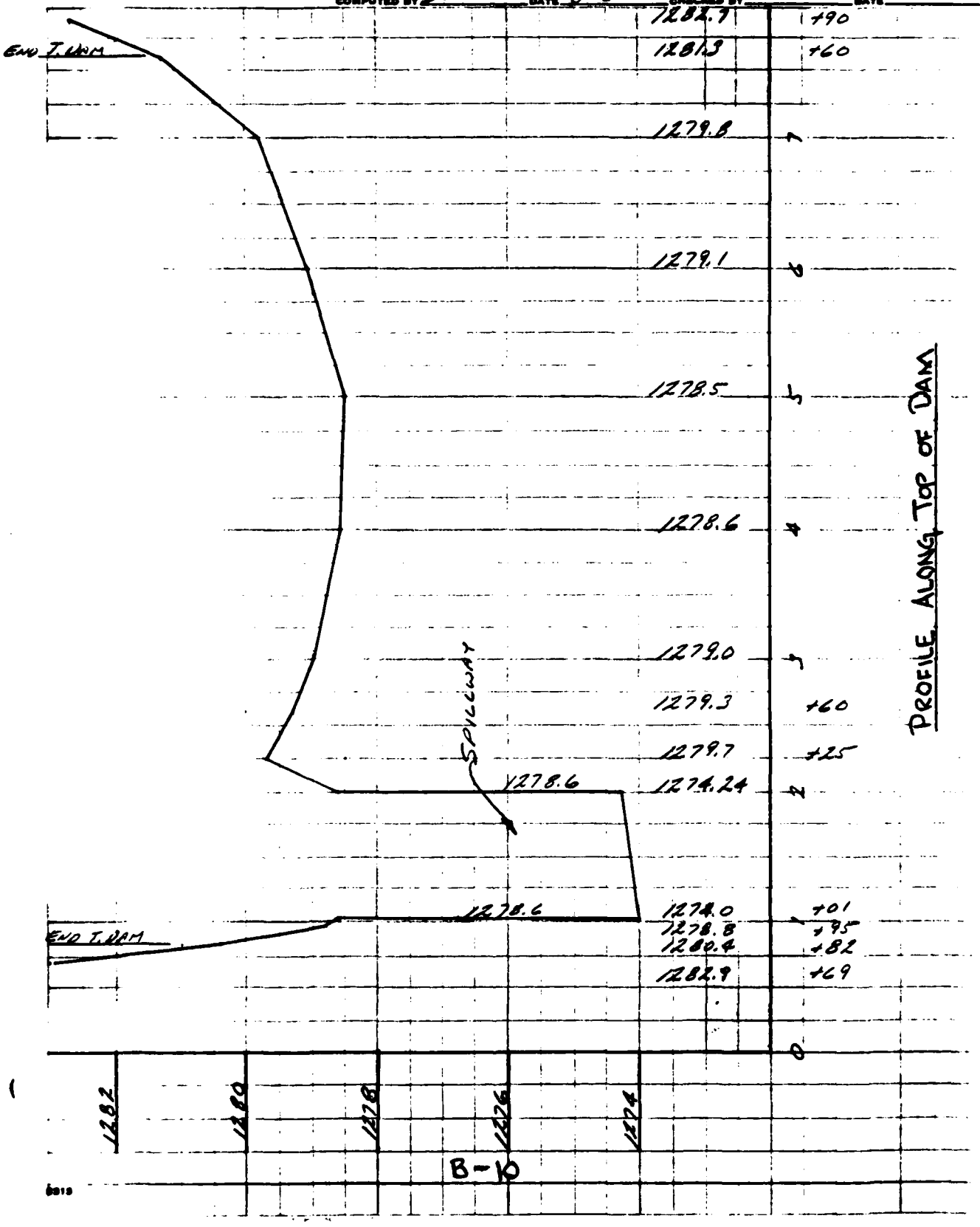
RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Generally mild, wooded slopes.	
SEDIMENTATION	None reported.	
WATERSHED DESCRIPTION	Approx. 90% wooded and 10% grassland. Swampy areas common.	

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

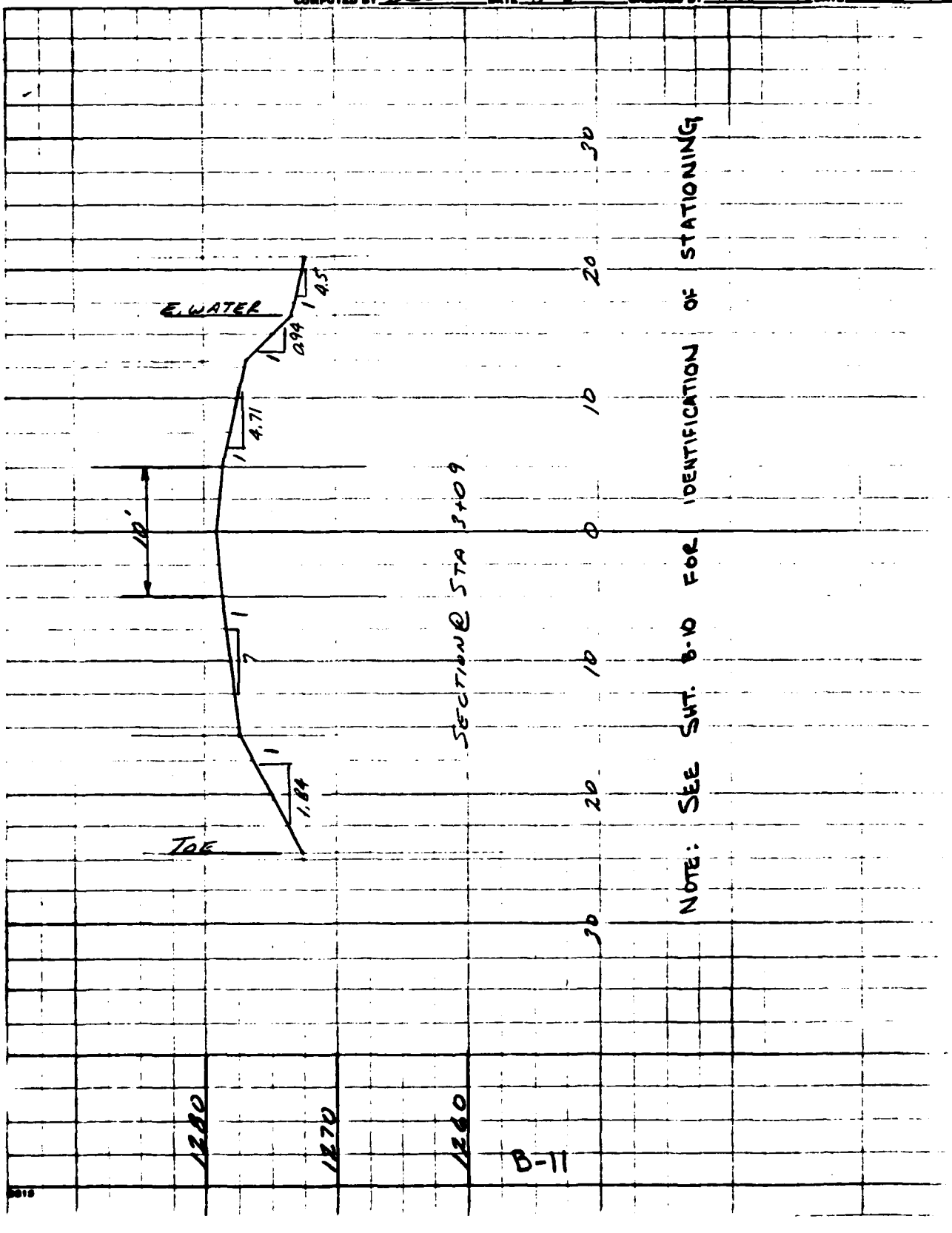
SUBJECT: BROWNS DAM — PROFILE - TOP of DAM
FILE NO. 8202
SHEET NO. 1 OF ____ SHEETS
FOR
COMPUTED BY DLE DATE 5-80 CHECKED BY DATE



5915

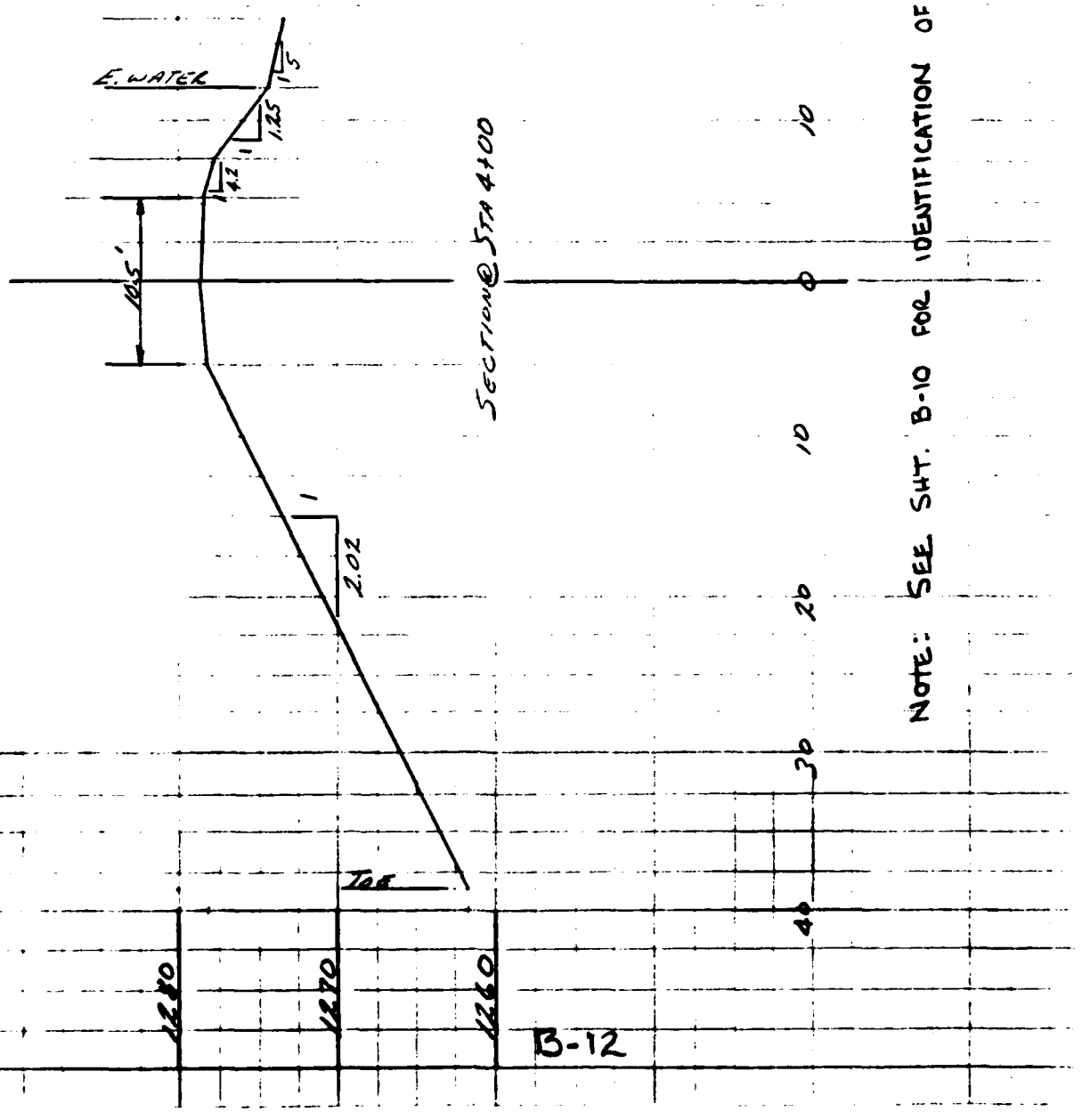
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT BROWNS DAM FILE NO. 8202
CROSS SECTION of EMBANKMENT SHEET NO. 3 OF ____ SHEETS
FOR
COMPUTED BY DLE DATE 5-80 CHECKED BY ____ DATE ____



GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT BROWNS DAM FILE NO. 1202
CROSS SECTION of EMBANKMENT SHEET NO. 2 OF ____ SHEETS
FOR
COMPUTED BY DRG DATE 5-80 CHECKED BY ____ DATE ____

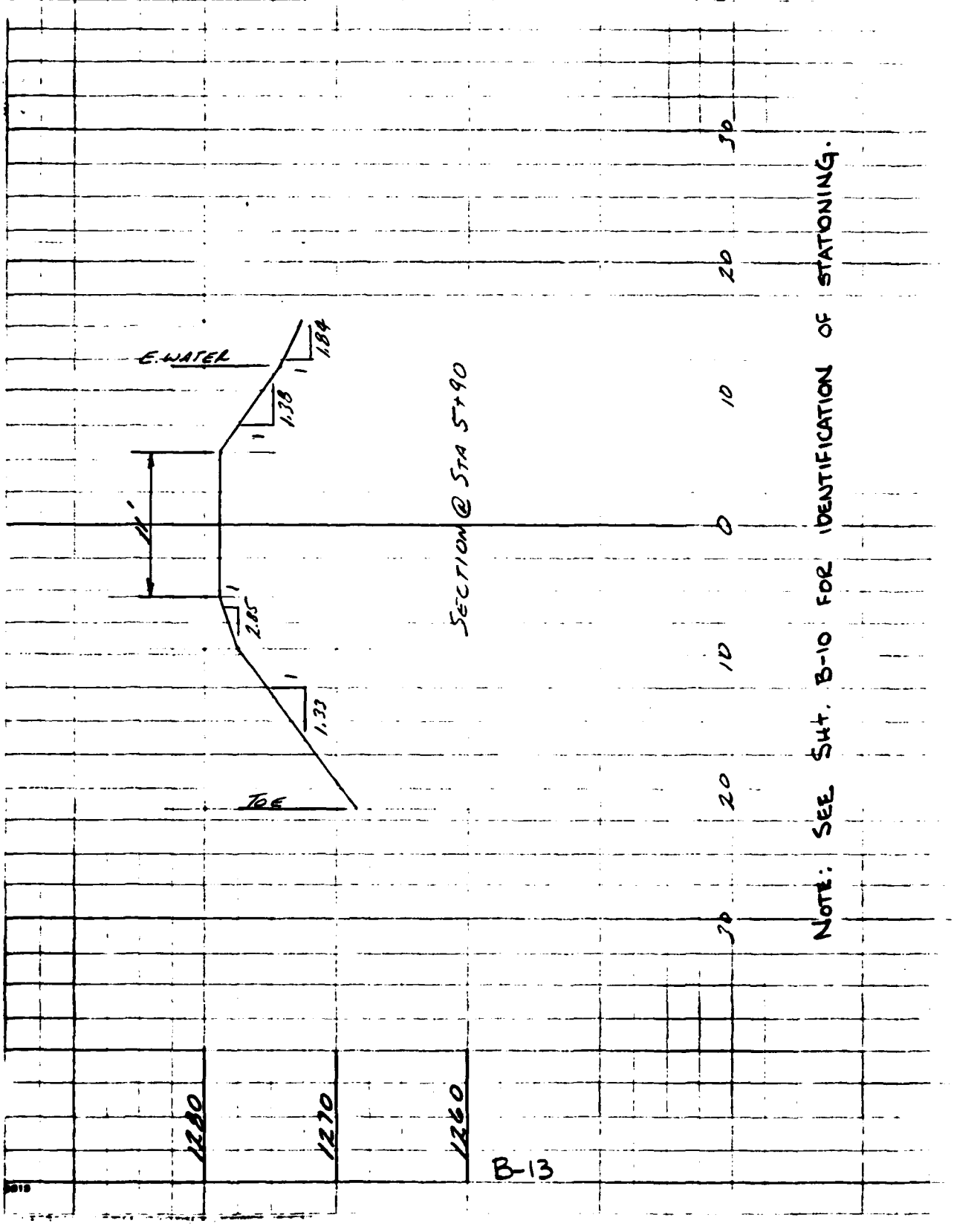


NOTE: SEE SHT. B-10 FOR IDENTIFICATION OF STATIONING

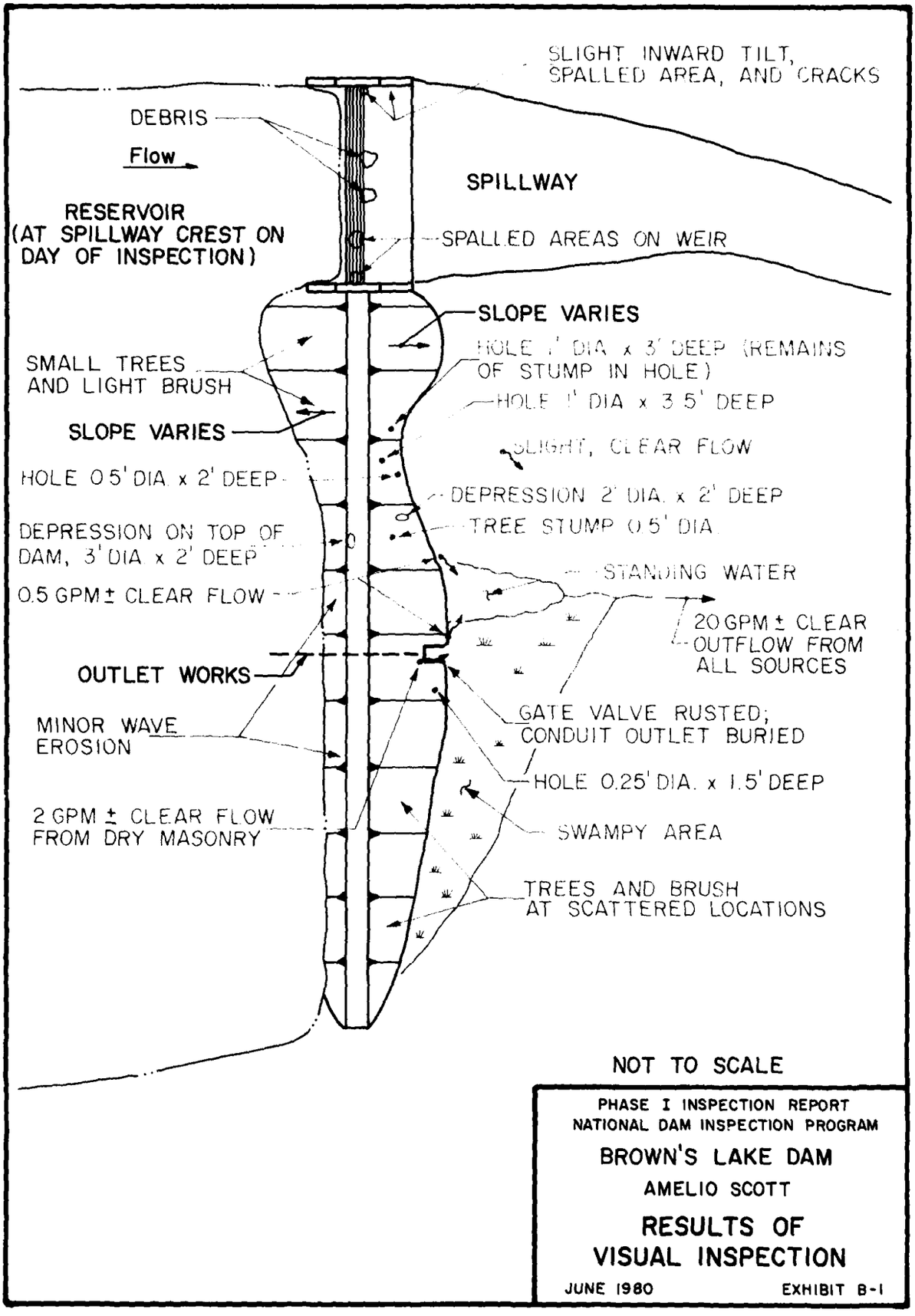
B-12

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT BROWNS DAM FILE NO. 8202
CROSS SECTION OF EMBANKMENT SHEET NO. 4 OF ___ SHEETS
FOR
COMPUTED BY DRE DATE 5-80 CHECKED BY ___ DATE ___



B-13



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BROWN'S LAKE DAM

AMELIO SCOTT

RESULTS OF VISUAL INSPECTION

JUNE 1980 EXHIBIT B-1

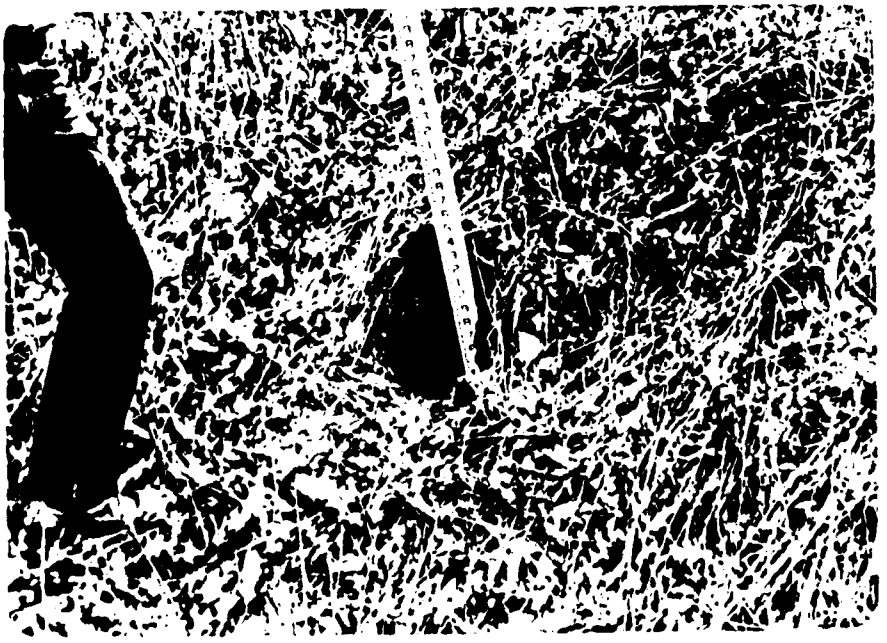
APPENDIX C

PHOTOGRAPHS

A. Upstream Slope.

B. Depression on Top of Dam.

C. Downstream Slope.



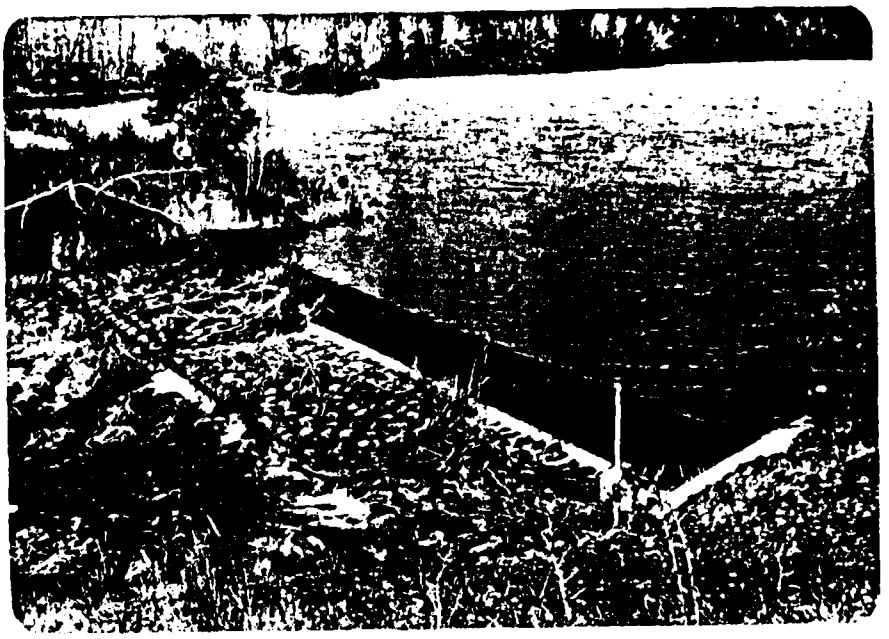
D. [illegible] Downstream Slope.

E. Hole on Downstream Slope.

F. Hole on Downstream Slope.

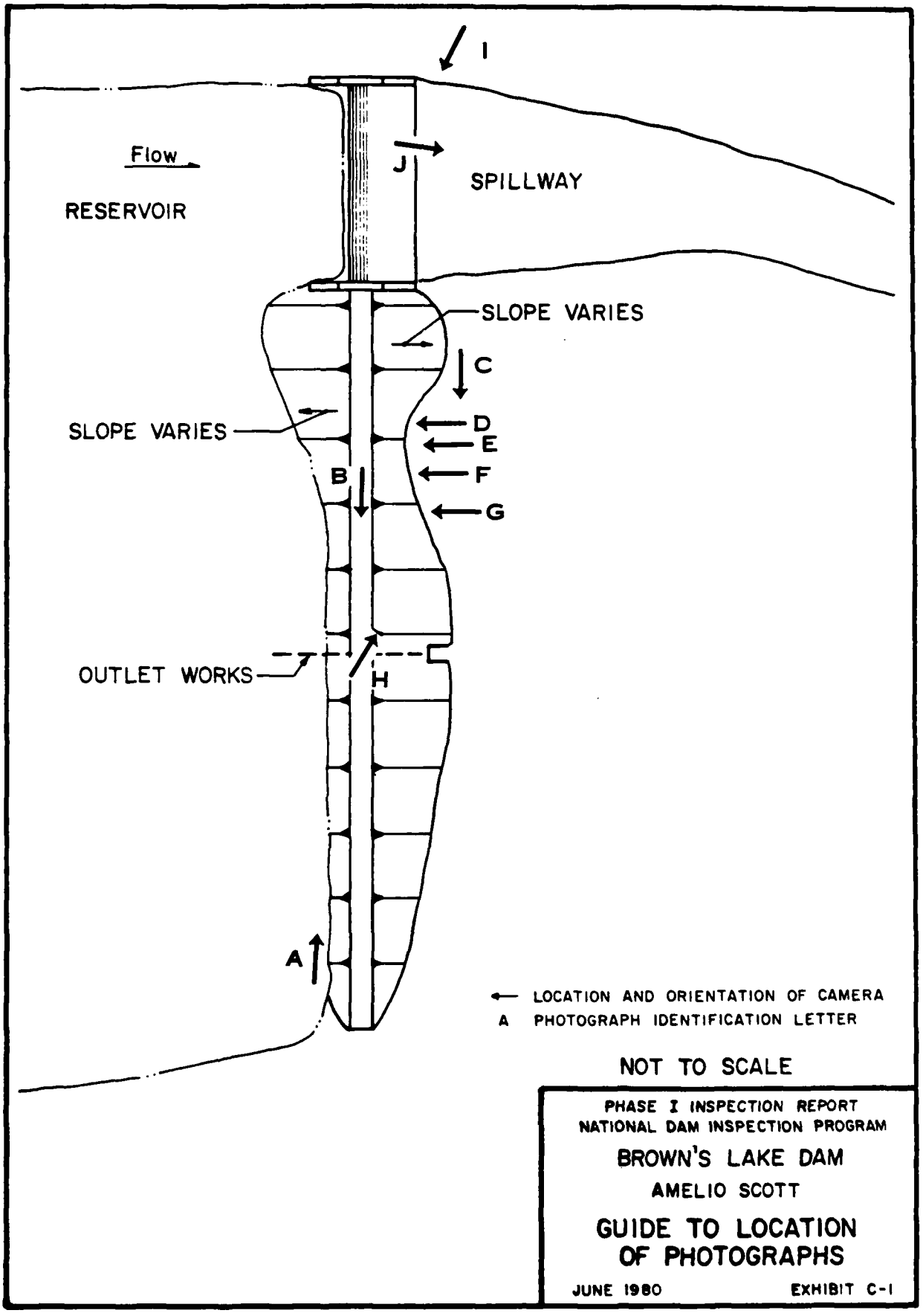
G. Depression on Downstream Slope.

H. Standing Water at Toe of Dam.



I. Spillway.

J. Spillway Outlet Channel.



NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BROWN'S LAKE DAM

AMELIO SCOTT

GUIDE TO LOCATION OF PHOTOGRAPHS

JUNE 1980 EXHIBIT C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

Delaware River Basin
Name of Stream: Stony Run
Name of Dam: Brown's Lake Dam
NDI ID No.: PA - 00630
DER ID No.: 45 - 108
Latitude: N 41° 12' 30" Longitude: W 75° 11' 20"
Top of Dam Elevation: 1278.5
Streambed Elevation: 1260.9 Height of Dam: 17.6 ft
Reservoir Storage at Top of Dam Elevation: 1121 acre-ft
Size Category: Intermediate Size (based on storage)
Hazard Category: High Hazard (see Section 5)
Spillway Design Flood: Probable Maximum Flood (PMF)

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
	NO UPSTREAM DAMS.			

DOWNSTREAM DAMS

	NO DOWNSTREAM DAMS.			

Delaware River Basin

Name of Stream: Stony Run

Name of Dam: Brown's Lake Dam

DETERMINATION OF PMF RAINFALL & UNIT HYDROGRAPH

UNIT HYDROGRAPH DATA:

Sub-area	Drainage Area (square miles)	Cp (1)	Ct (2)	L miles (3)	L_{ca} miles (4)	L' miles (5)	Tp hours (6)	Map Area (7)	Plate (8)
A-1	2.40	0.45	1.23	3.52	1.25	—	1.9	1	A
Total	2.40								

(See Sketch on Sheet D-4)

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

The following are measured from the outlet of the subarea:

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

The following is measured from the upstream end of the reservoir at normal pool:

(5): Length of main watercourse extended to divide

(6): $Tp=C_t \times (L \times L_{ca})^{0.3}$, except where the centroid of the subarea is located in the reservoir. Then $Tp=C_t \times (L')^{0.6}$

Initial flow is assumed at 1.5 cfs/sq. mile

Computer Data: QRCSN = -0.05 (5% of peak flow)
RTIOR = 2.0

RAINFALL DATA:

PMF Rainfall Index= 22.1 in., 24 hr., 200 sq. mile

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone:	N/A	1
Geographic Adjustment Factor:	N/A	1.0
Revised Index Rainfall:	N/A	22.1

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	—
96 hours	—

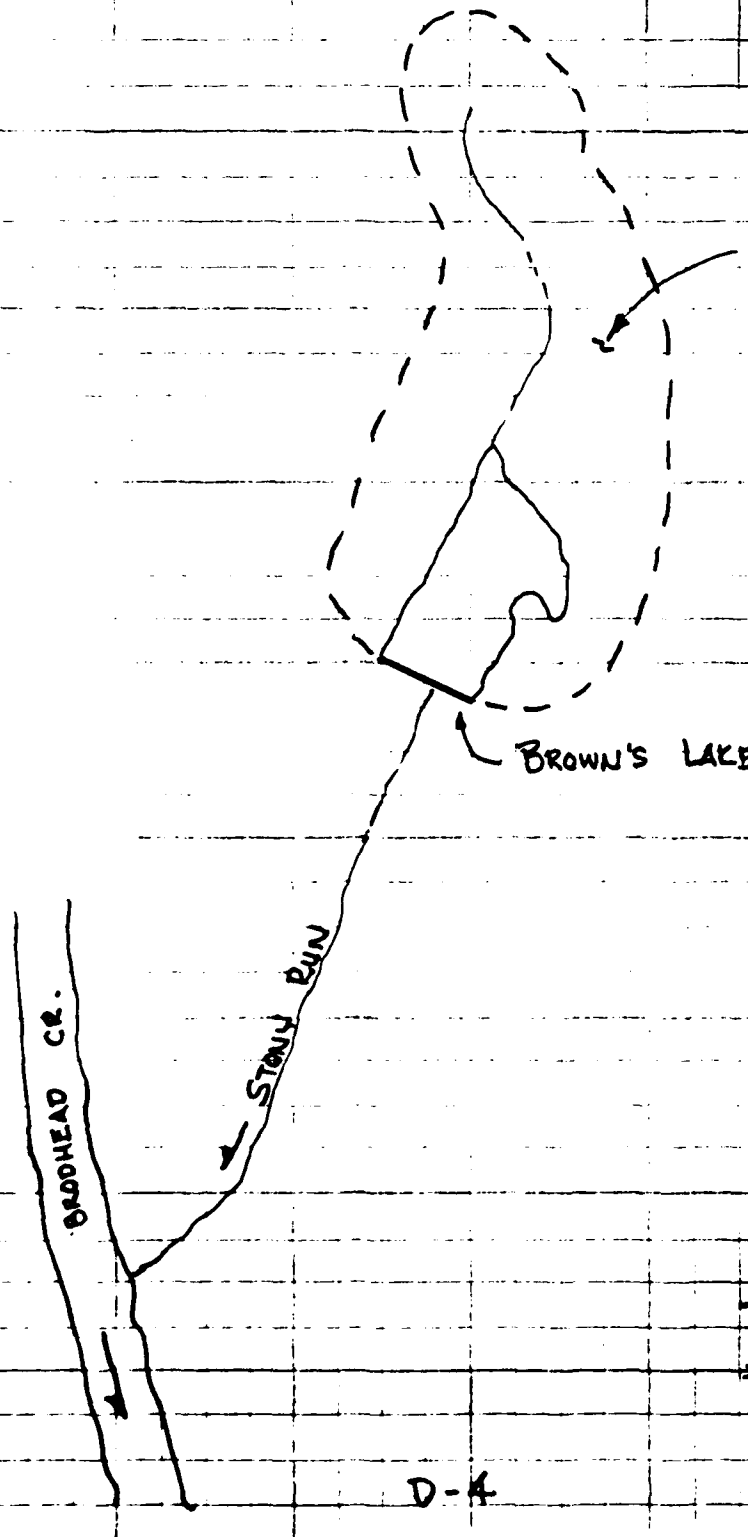
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____

SHEET NO. ____ OF ____ SHEETS

FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



BROWN'S LAKE DAM
SKETCH OF SYSTEM

NOT TO SCALE

Data for Dam at Outlet of Subarea A-1 (See sketch on Sheet D-4)

Name of Dam: Brown's Lake Dam

STORAGE DATA:

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1261.0 =ELEVO	0	0	0	* Streambed elev.
1274.0 =ELEV1	115 =A1	162	498 =S1	Area from DER files
1278.5	163	365	1121	Top of Dam
1290.0	181	449	1379	Planimetered area
1300.0 **	275	1924	5906	

* $S_1 = \frac{A_1 (ELEV\,1 - ELEVO)}{3}$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 7 percent of subarea watershed.

BREACH DATA:

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: Silty Sand

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) 2 fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = 0.2 ft., C = 3.1 Top of Dam El.= 1278.5

HMAX + Top of Dam El. = 1278.7 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = _____ ft (width of bottom of breach)
Z = _____ (side slopes of breach)
ELBM = _____ (bottom of breach elevation, minimum of zero storage elevation)
WSEL = _____ (normal pool elevation)
T FAIL= _____ mins = _____ hrs (time for breach to develop)

Data for Dam at Outlet of Subarea A-1

Name of Dam: Brown's Lake Dam

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	1278.5	N/A
Spillway Crest Elevation	1274.1	N/A
Spillway Head Available (ft)	4.4	N/A
Type Spillway	Triangular concrete weir	
"C" Value - Spillway	3.5	
Crest Length - Spillway (ft)	99.0	
Spillway Peak Discharge (cfs)	3,198	
Auxiliary Spillway Crest Elev.	N/A	
Auxiliary Spill. Head Avail. (ft)	N/A	
Type Auxiliary Spillway	N/A	N/A
"C" Value - Auxiliary Spill. (ft)	N/A	
Crest Length - Auxil. Spill. (ft)	N/A	
Auxiliary Spillway Peak Discharge (cfs)	N/A	
Combined Spillway Discharge (cfs)	3,198	

Spillway Rating Curve: $Q = (3.5)(99)H^{3/2}$

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
1274.1	0	N/A	N/A
1275.0	296		
1278.5	3,198		

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	Not applicable for analysis	N/A	N/A
Invert of Inlet			
Type			
Diameter (ft) = D			
Length (ft) = L			
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction = $29.1N^2L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5} = C$			
Maximum Head (ft) = HM			
$Q = CA\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)			

Selected Computer Output

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
    1                 A1                                NATIONAL DAM INSPECTION PROGRAM
    2                 A2                                          STONY RUN
    3                 A3                                     BROWNS LAKE DAM
    4                 B    300       0       15        0        0        0        0        0       -4        0
    5                 B1     5
    6                 J      1       6        1
    7                 J1     1      .9       .8       .7       .6       .5
    8                 K      0       1                          0        0        1
    9                 K1       INFLOW TO DAM
   10                 M      1       1      2.4                 0        0                          1
   11                 P      0    22.1      111      123      133      142
   12                 T                                                        1.0      .05               .07
   13                 W    1.9     .45
   14                 X   -1.5    -.05      2.0
   15                 K      1       1                          0        0        1
   16                 K1       ROUTE THROUGH DAM
   17                 Y                                  1
   18                 Y1     1                                                -1274.1       0
   19                 $A     0     115      163      181      275
   20                 $E1261.0  1274.0   1279.5   1280.0   1300.0
   21                 $S1274.1    99.0      3.5      1.5
   22                 $D1278.5
   23                 $L     1     100      280      415      520      600
   24                 $V1278.5  1278.6   1279.0   1279.5   1280.0   1282.0
   25                 K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50
HYDROGRAPH AT	1	2.40	1	4908.	4418.	3927.	3436.	2945.	2454.
	(	6.22)	(	138.99)(	125.09)(	111.19)(	97.29)(	83.40)(	69.50)(
ROUTED TO	1	2.40	1	4042.	3533.	3098.	2692.	2286.	1881.
	(	6.22)	(	114.47)(	100.05)(	87.74)(	76.23)(	64.74)(	53.28)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1274.10	1274.10	1278.50
STORAGE	510.	510.	1121.
OUTFLOW	0.	0.	3198.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1279.07	.57	1216.	4042.	3.25	43.25	0.00
.90	1278.77	.27	1165.	3533.	2.25	43.25	0.00
.80	1278.41	0.00	1106.	3098.	0.00	43.50	0.00
.70	1278.02	0.00	1044.	2692.	0.00	43.50	0.00
.60	1277.62	0.00	981.	2286.	0.00	43.50	0.00
.50	1277.19	0.00	917.	1881.	0.00	43.50	0.00

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

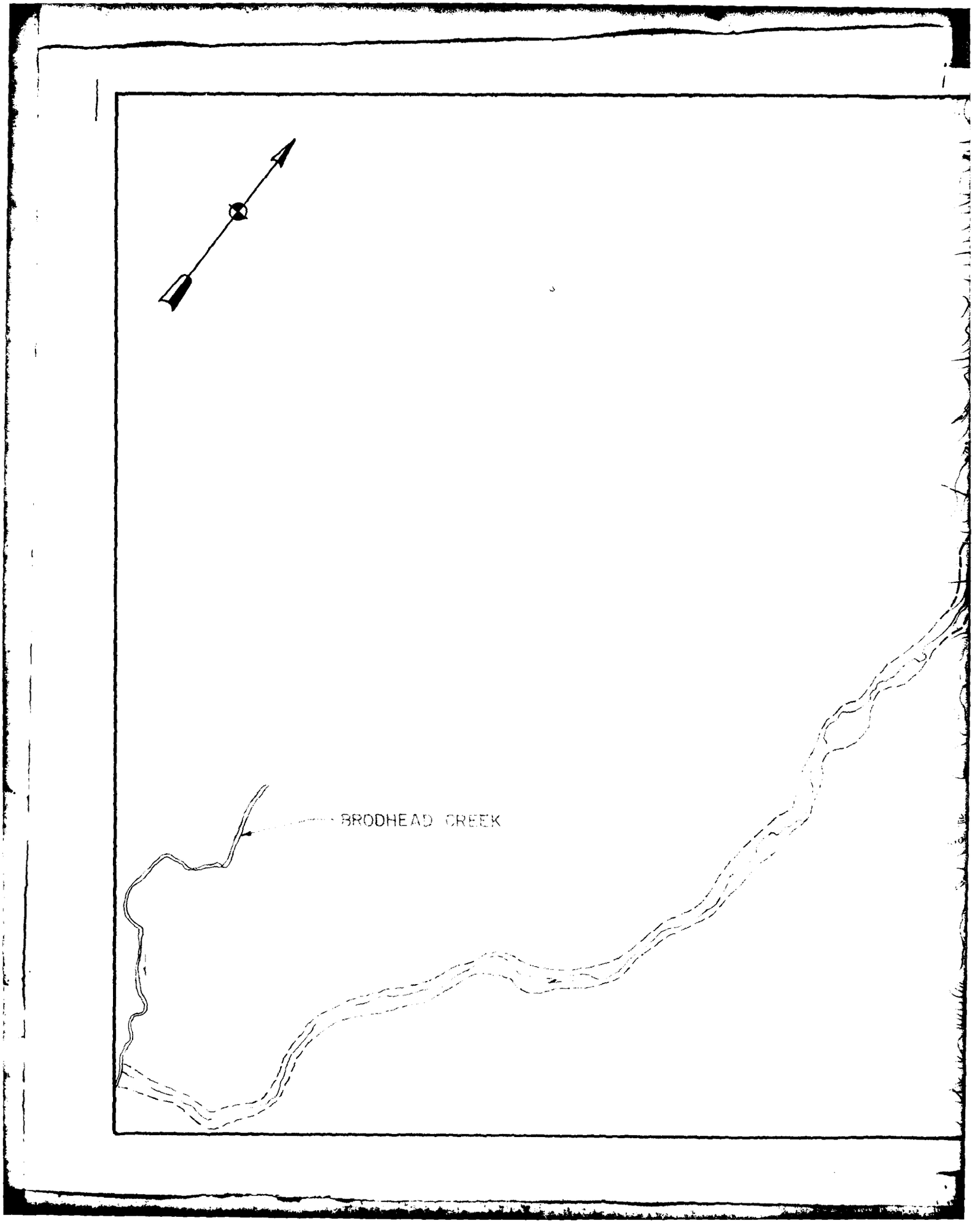
SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

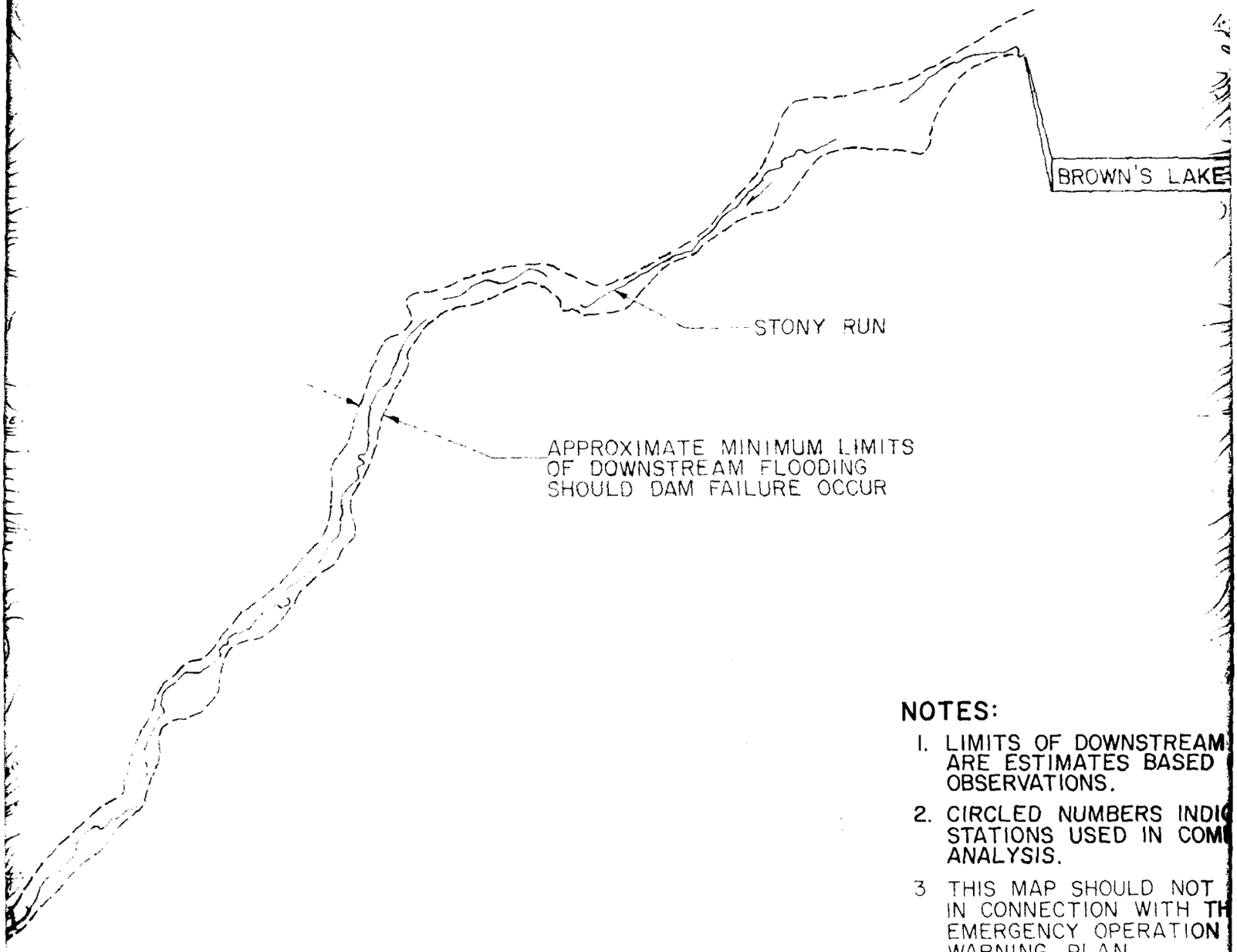
Brown's Lake Dam
Summary of Pertinent Results

PMF Rainfall = 25.11 inches

	PMF	½ PMF
Runoff (inches)	22.88	11.44
Peak Inflow (cfs)	4,908	2,454
Peak Outflow (cfs)	4,042	1,681
Depth of Overtopping (ft)	0.57	0
Duration of Overtopping (hr)	3.25	0

8913


BRODHEAD CREEK



NOTES:

1. LIMITS OF DOWNSTREAM
ARE ESTIMATES BASED
OBSERVATIONS.
2. CIRCLED NUMBERS INDI
STATIONS USED IN COM
ANALYSIS.
3 THIS MAP SHOULD NOT
IN CONNECTION WITH TH
EMERGENCY OPERATION
WARNING PLAN.

2000 0 2000

SCALE: 1 IN. = 2000 FT.

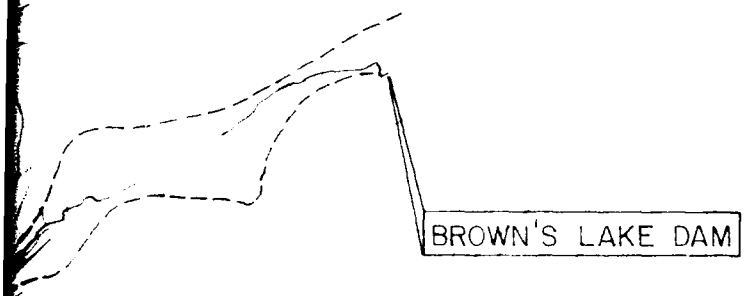
PHASE I INSPECTIO
NATIONAL DAM INSPECT

BROWN'S LAK

AMELIO SC

DOWNSTR
DEVELOPMENT

JUNE 1980



STONY RUN

NIMUM LIMITS
FLOODING
LURE OCCUR

NOTES:

1. LIMITS OF DOWNSTREAM FLOODING ARE ESTIMATES BASED ON VISUAL OBSERVATIONS.
2. CIRCLED NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.
3. THIS MAP SHOULD NOT BE USED IN CONNECTION WITH THE EMERGENCY OPERATION AND WARNING PLAN.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BROWN'S LAKE DAM

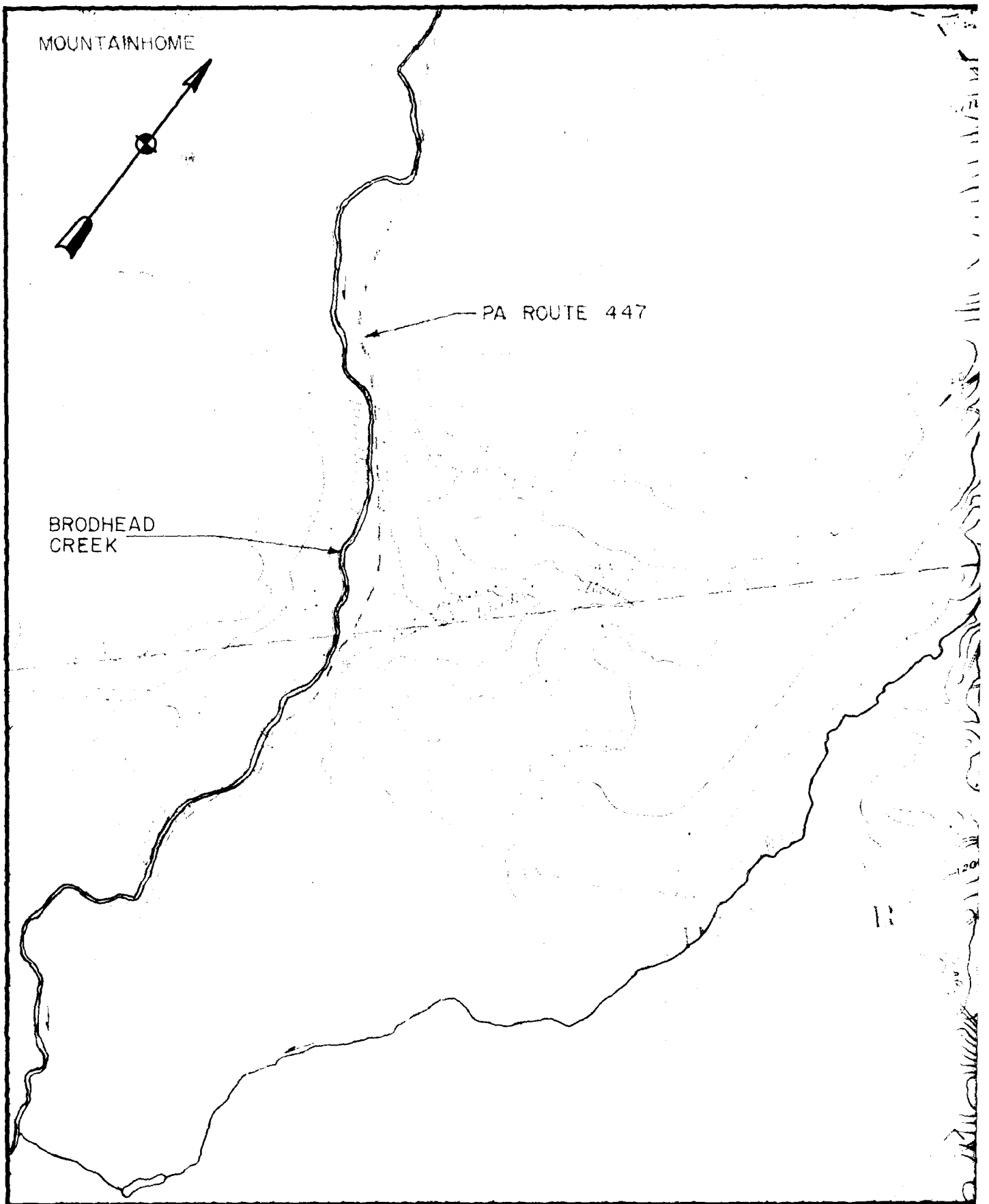
AMELIO SCOTT

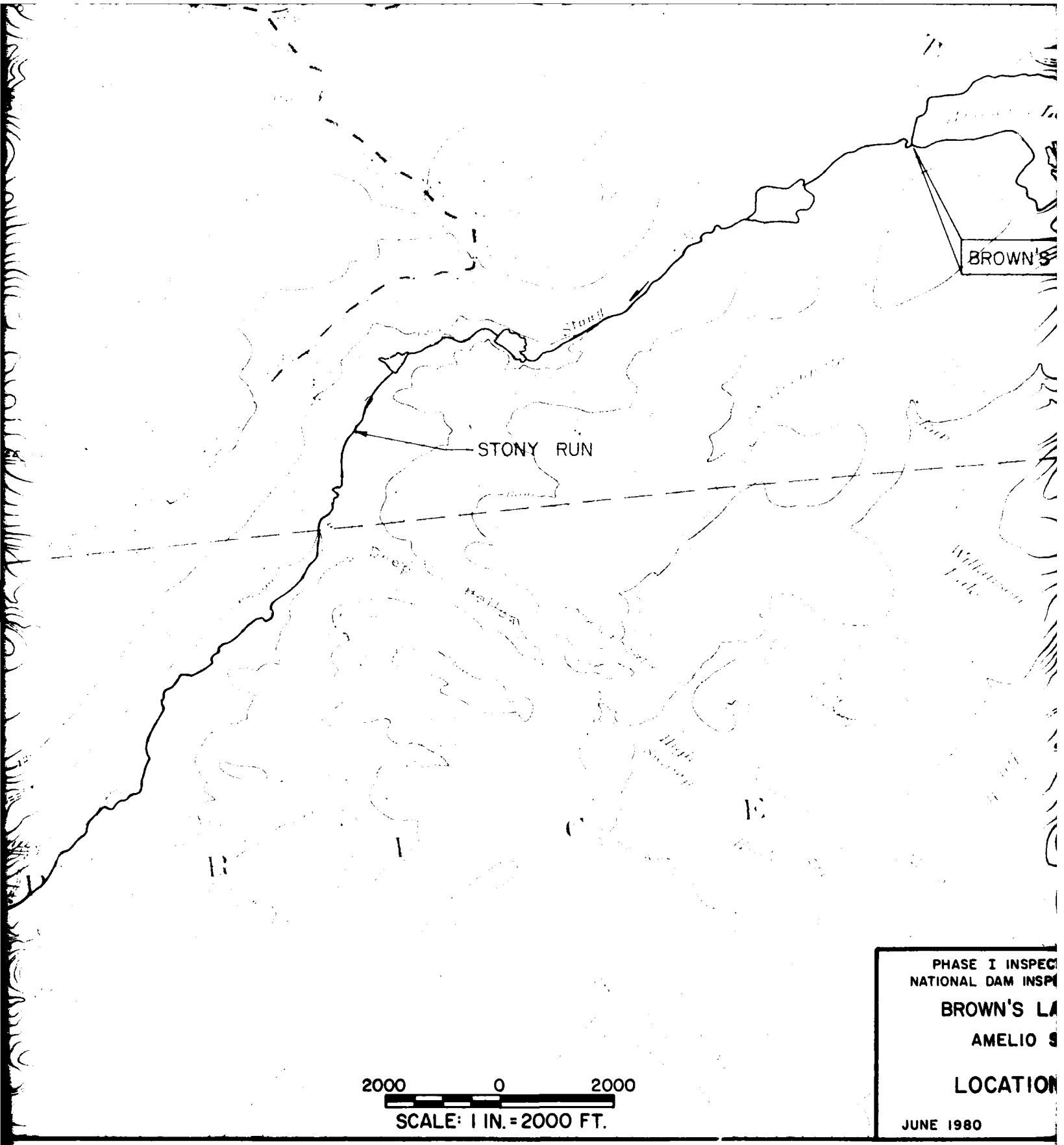
DOWNSTREAM DEVELOPMENT PLAN

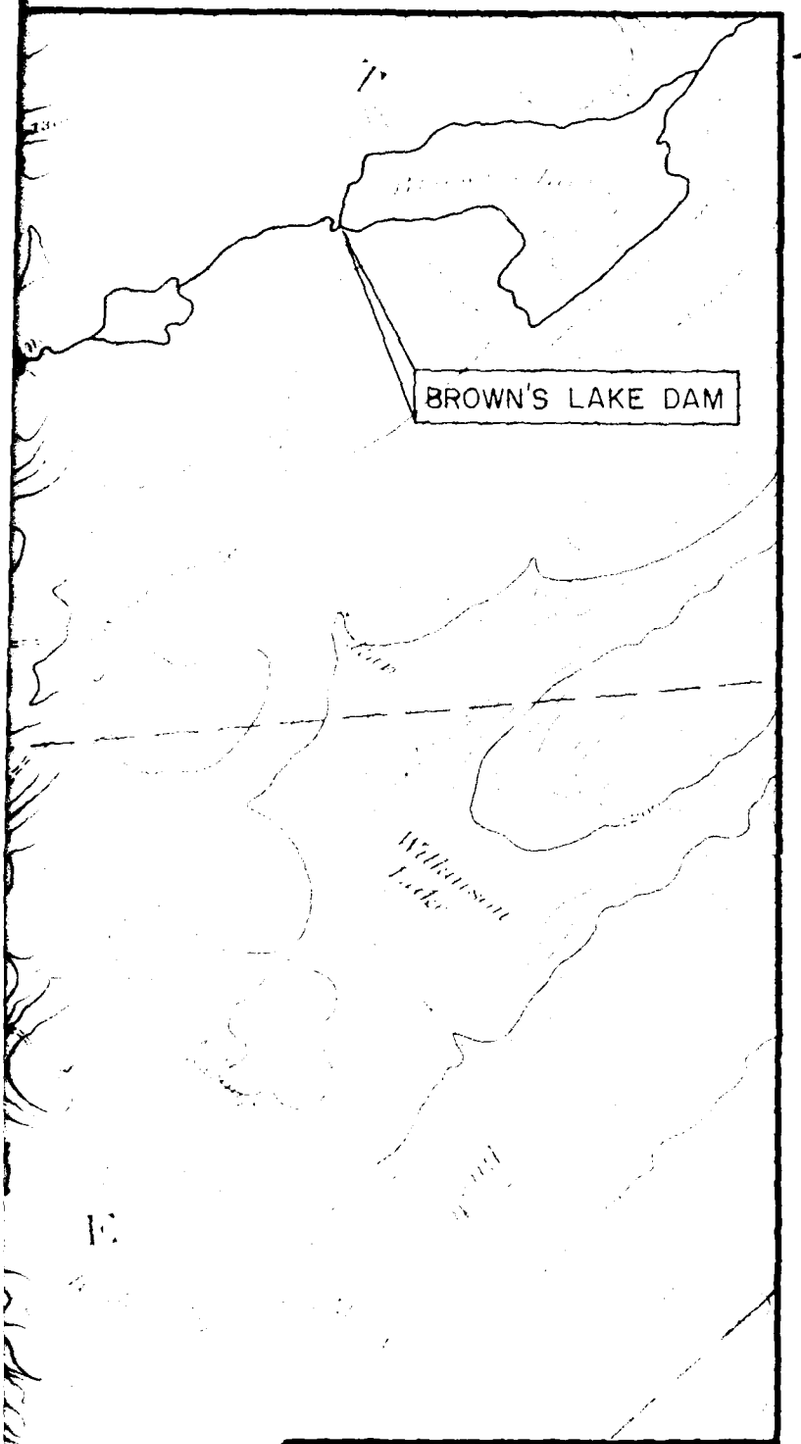
JUNE 1980 EXHIBIT D-1

APPENDIX E

PLATES


MOUNTAINHOME
PA ROUTE 447
BRODHEAD
CREEK


BROWN'S
STONY RUN
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPEC
NATIONAL DAM INSP
BROWN'S LA
AMELIO S
LOCATION
JUNE 1980



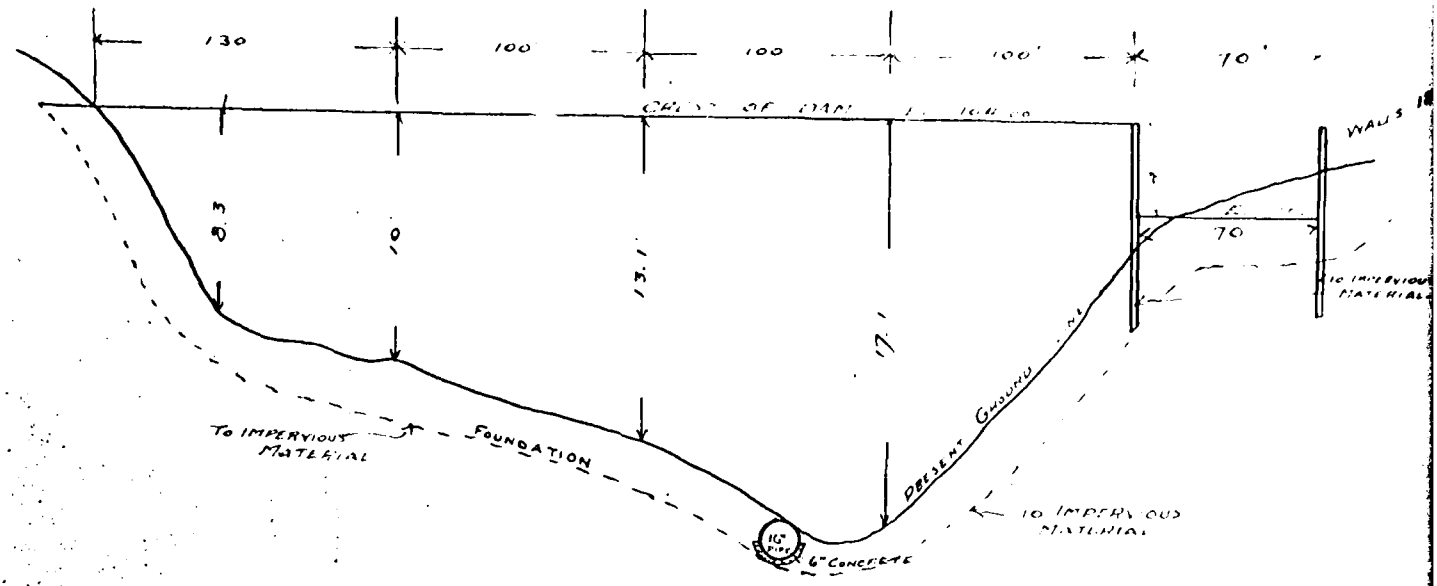
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BROWN'S LAKE DAM

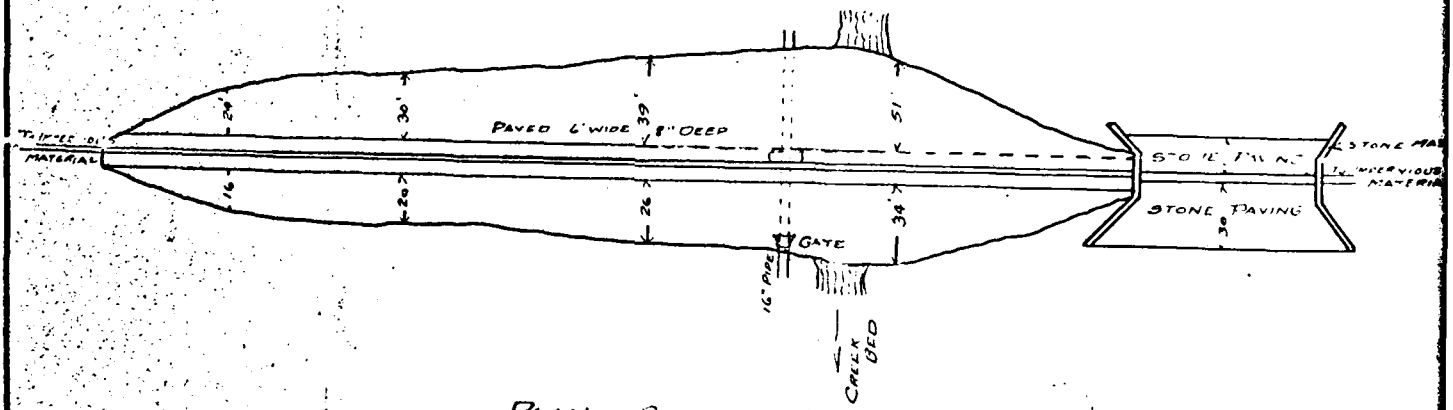
AMELIO SCOTT

LOCATION MAP

JUNE 1980 PLATE E-1

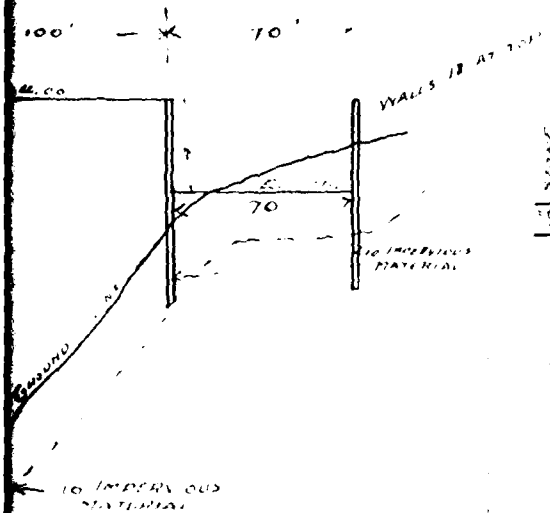


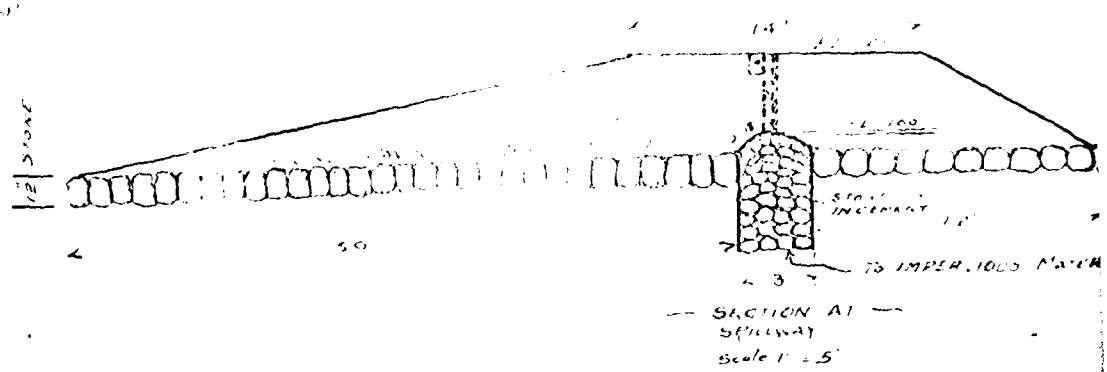
PROFILE ; 1" = 50'



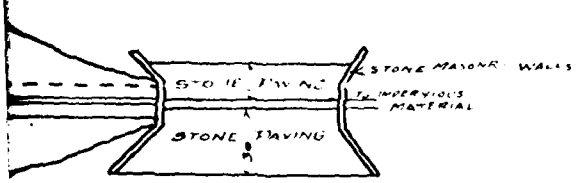
PLAN SCALE 1" = 50'

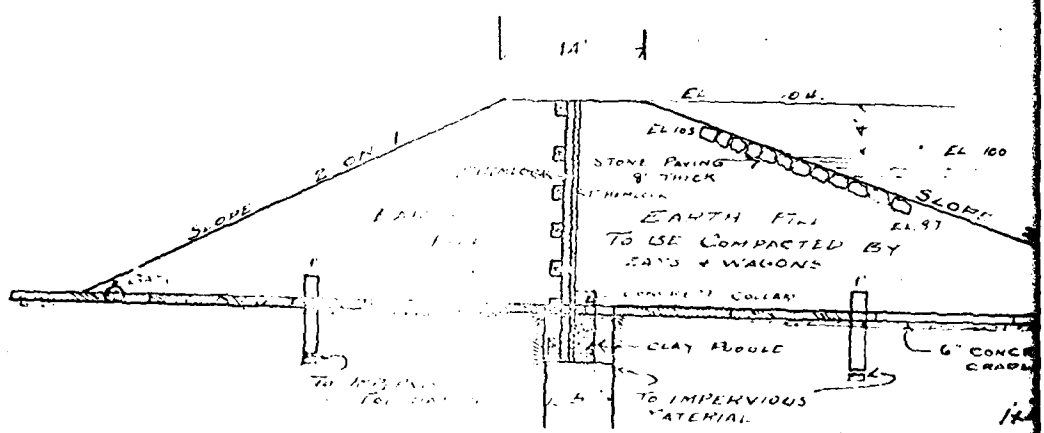
2 1





— SECTION A1 —
SPILLWAY
Scale 1" = 5'

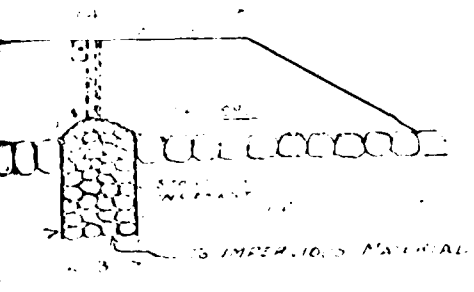




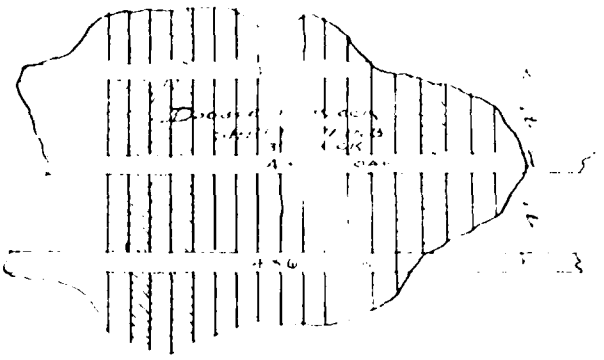
Scale 1" = 10 Ft

MASONRY SECTION :-

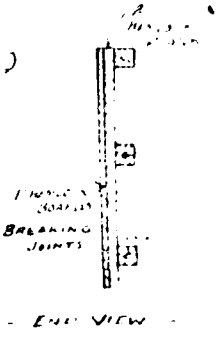
3



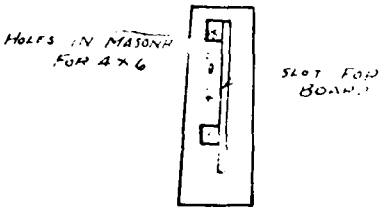
SECTION AT SPILLWAY
Scale 1" = 5'



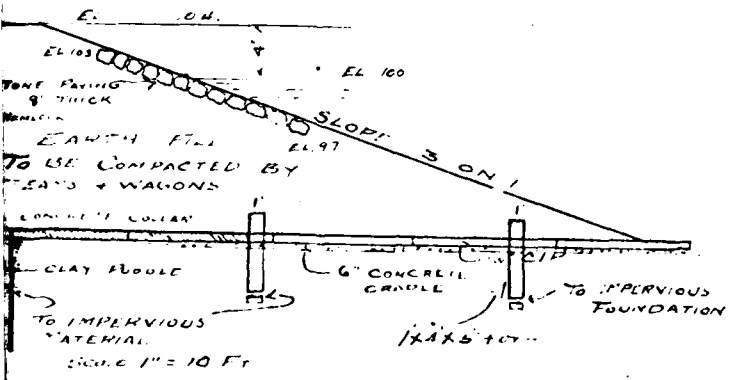
SECTION SHEET PILING 1" = 5'



END VIEW



CONNECTION BETWEEN TIMBER & STONE CONC WALL



SCALE 1" = 10 Ft

SECTION :-

— PLAN OF DAM —
FOR
— FRANK BROWN —
ON
— STONY RUN —

— J L Westbrook —
— County Engineer —
— Stroudsburg Pa. —

BARRETT TWP
MONROE Co.

Sheet

NOTES:

1. CHANGES MADE EMBANKMENT DURING ARE DESCRIBED IN S THIS REPORT.

2. SPILLWAY SHOP SHEET WAS WASHED THE AUGUST 1955

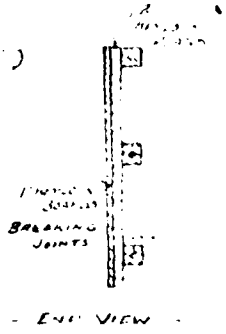
PHASE I IN NATIONAL DAM

BROWN'S

AMEL

ORIGINAL

JUNE 1980



END VIEW

NOTES:

1. CHANGES MADE TO THE EMBANKMENT DURING CONSTRUCTION ARE DESCRIBED IN SECTION 1 OF THIS REPORT.

2. SPILLWAY SHOWN ON THIS SHEET WAS WASHED OUT DURING THE AUGUST 1955 FLOOD.

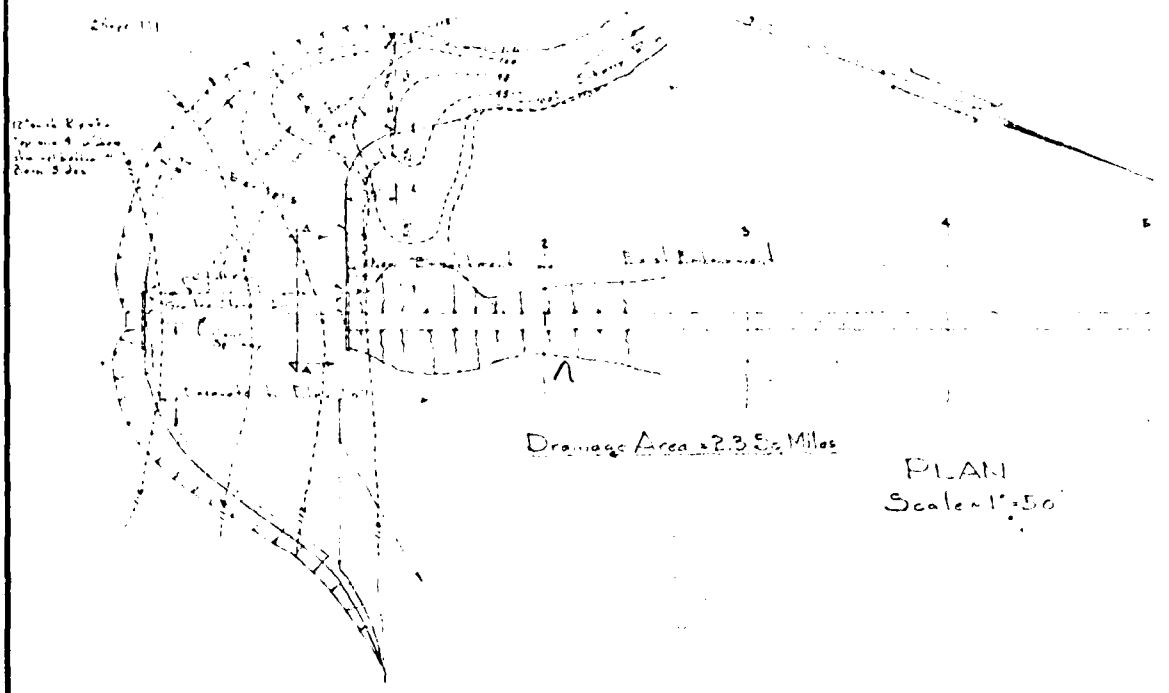
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BROWN'S LAKE DAM

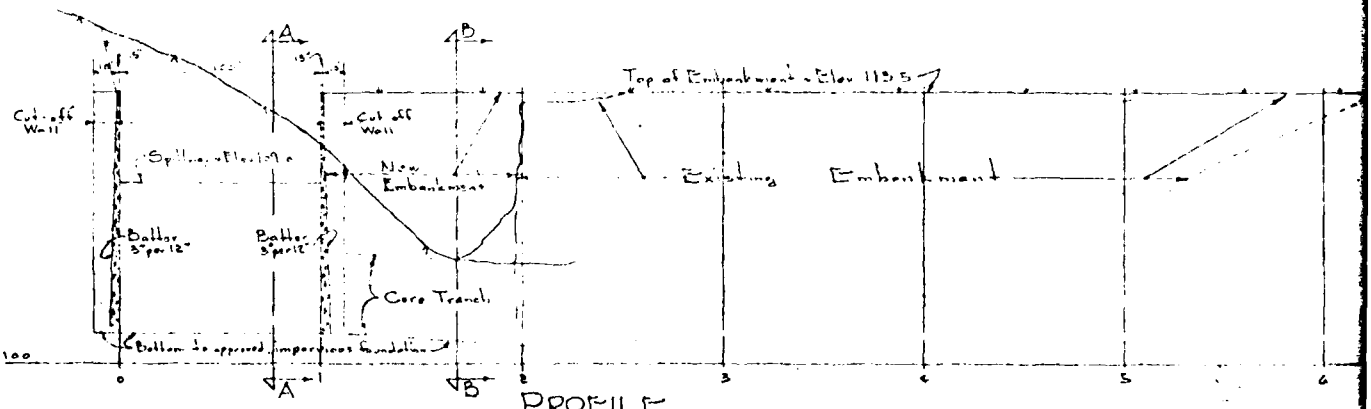
AMELIO SCOTT

ORIGINAL DESIGN (1922)

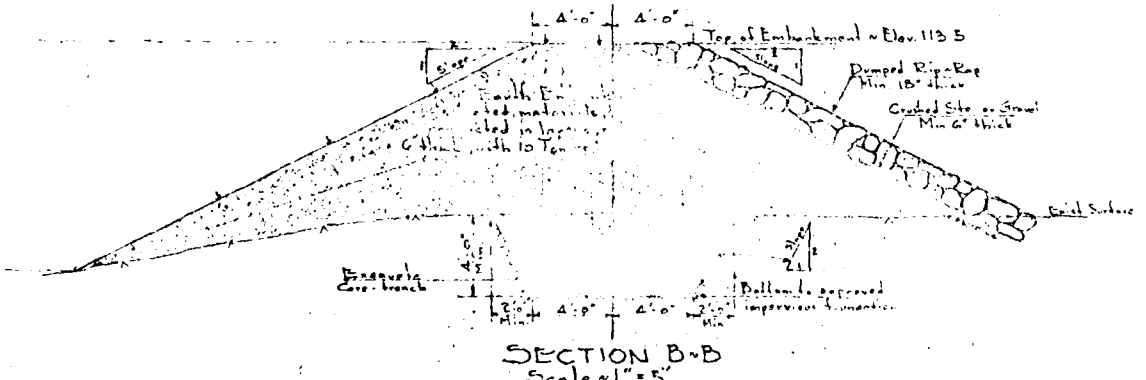
JUNE 1980 PLATE E-2



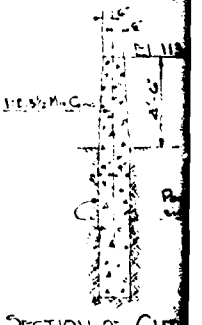
PLAN
Scale = 1" = 50'



PROFILE
Scales Hor. = 1" = 50'
Vert. = 1" = 5'



SECTION B-B
Scale = 1" = 5'

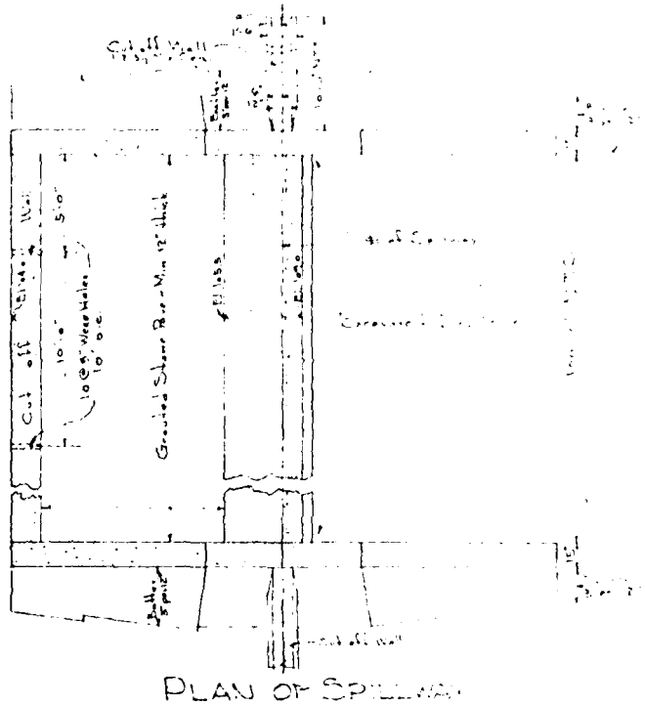


SECTION OF CUT
Scale = 1"

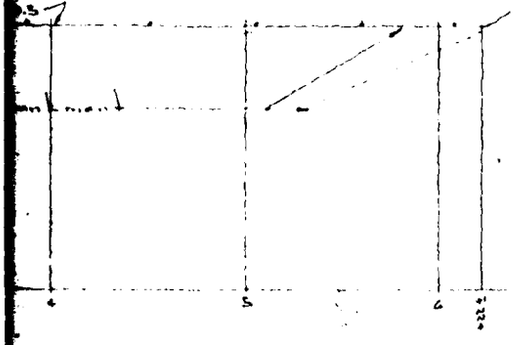
2

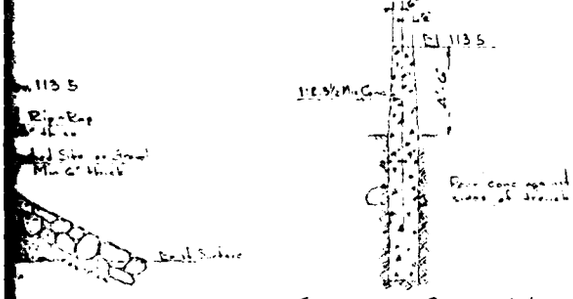
SECTION A-A
Scale - 1" = 5'

PLAN
Scale - 1" = 50'



PLAN OF SPILLWAY
Scale - 1" = 5'





SECTION OF CUT-OFF WALL
Scale - 1" = 5'

PLANS AND SECTIONS FOR CONSTRUCTION OF
NEW SPILLWAY ON BROWN'S LAKE
CARL W. BROWN - OWNER
BARRETT TWP., MONROE CO., PA.
SEPTEMBER 25, 1955. SCALES AS SHOWN

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BROWN'S LAKE DAM

AMELIO SCOTT

1955 MODIFICATIONS

JUNE 1980 PLATE E-3

APPENDIX F

GEOLOGY

BROWN'S LAKE DAM

APPENDIX F

GEOLOGY

Brown's Lake Dam is located in Monroe County within the Appalachian Plateau Province. The most pronounced topographic feature in the area is Camelback Mountain, which is a part of the Pocono Plateau Escarpment. The escarpment has a well-defined, southwestward trend from Camelback Mountain, but is more irregular between Camelback Mountain and Mt. Pocono, which lies to the north. Streams east of the escarpment drain directly to the Delaware River, while those to the west drain to the Lehigh River.

The Pocono Plateau Section lies to the west of the escarpment. This area is relatively flat, with local relief seldom exceeding 100 feet. The topography has been greatly influenced by continental glaciation. Many topographic features were created by deposition of glacial materials. The remainder of the plateau has relatively smooth topography, and the entire plateau lacks well-developed drainage.

East of the escarpment is the Glaciated Low Plateaus section of the province. This area is characterized by pre-glacial, erosional topography with locally-thick glacial deposits. Local relief is generally 100-300 feet.

Bedrock units of the sections described above are the lithified sediments of offshore marine, marginal marine, deltaic, and fluvial environments associated with the Devonian Period. These units include siltstones of the Mahantango Formation, siltstones and shales of the Trimmers Rock, and seven mapped members of the Catskill Formation. These members include sandstones, siltstone, and shales of the Towamensing Member; sandstone, siltstone and shale of the Walcksville Member; sandstones, siltstones, and shale of the Beaverdam Run Member; sandstone and shale in the Long Run Member; sandstones and conglomerates in the Packerton Member; sandstone and some conglomerates in the Poplar Gap Member; and sandstones and conglomerates in the Duncannon Member.

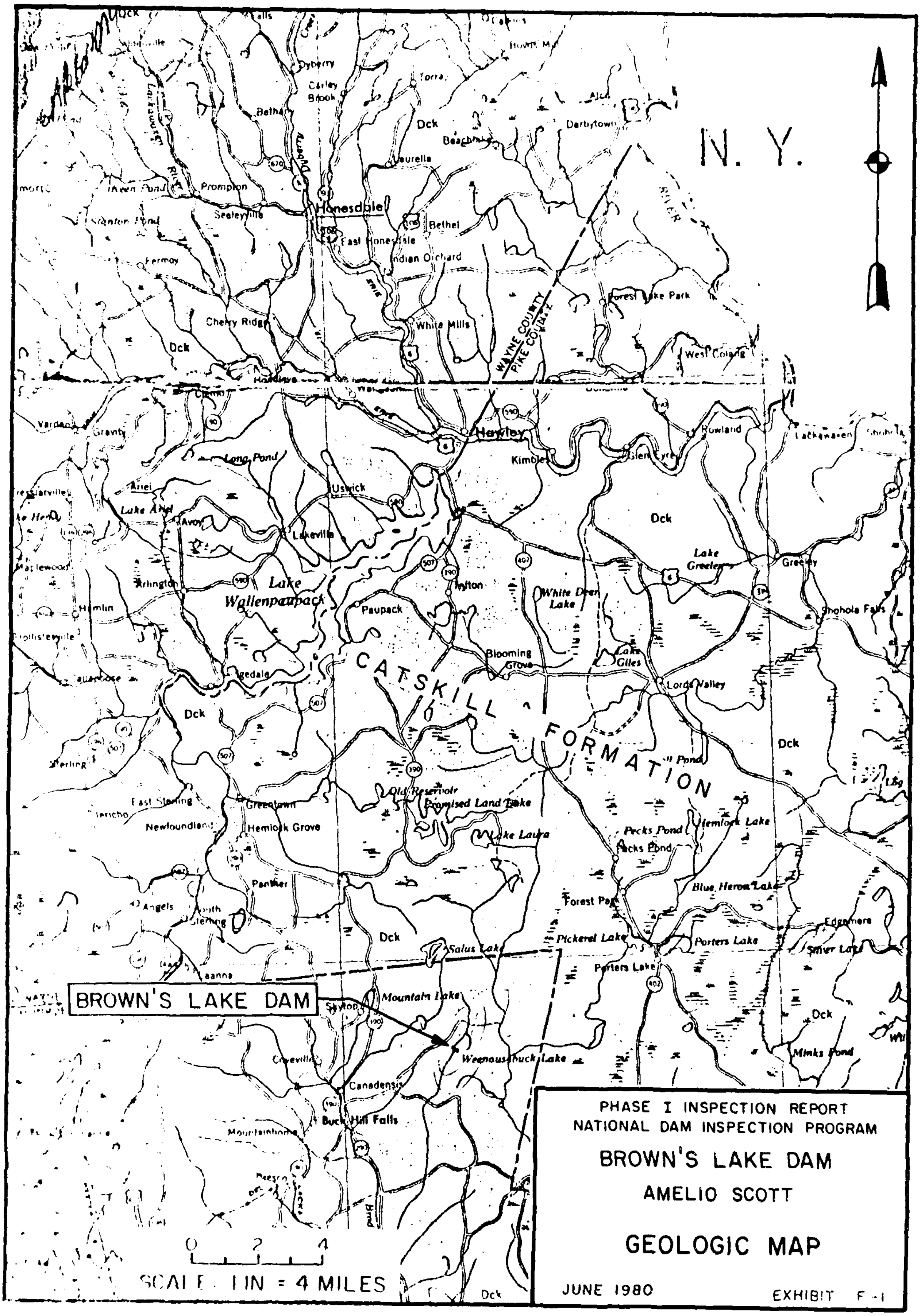
Brown's Lake Dam is underlain by the Long Run Member of the Catskill Formation. The Long Run Member is predominantly sandstone with interbedded siltstone and shale.

The sandstones are primarily fine- to medium-grained, composed of well-sorted, quartz grains with some rock fragments in a clay matrix with silica or carbonate cement. Low to moderate primary porosity, caused by weathering of the carbonate cement, combined with moderate to high fracture porosity, yields a significant effective porosity for the sandstones. Very fine-grained siltstones and clay shales that are present have low primary porosity. Secondary porosity attributable to fracturs is low to moderate.

The sandstones and siltstones of the Long Run Member maintain high angle cut slopes. The shales, when exposed, weather rapidly. Because of their relatively low porosity, the shales and fine-grained siltstones are well-suited for impoundment sites. When excavated to sound bedrock, the Long Run Member is reported to be a good foundation for heavy structures.

Available data indicate that Brown's Lake Dam is founded on overburden. The depth to bedrock at the site is unknown. The overburden consists mainly of Woodfordian Ground Moraine; this is a till with generally less than 35 percent silt and clay. It is moderately cohesive but could be sandy and loose in the upper parts of thick accumulations. Boulders of gray sandstone up to 3 feet in diameter are common. The thickness of the till varies between 5 feet and 100 feet; it averages about 33 feet. Some peat deposits have also been mapped in the reservoir area of Brown's Lake Dam.

Fracture traces have been mapped east and north of the embankment and they trend parallel with the valley. Major joint systems in the area are oriented N 17°E and N 30°E. These could provide seepage paths under the embankment, the axis of which is oriented about N 12°E.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
BROWN'S LAKE DAM
AMELIO SCOTT
GEOLOGIC MAP
JUNE 1980
EXHIBIT F-1